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Electricity

ELECTRICITY.

A POPULAR ELECTRICAL JOURNAL.

ILLUSTRATED.

PUBLISHED WEEKLY BY THE

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ELECTRICITY.

Vol. I. | Chicago. | July 22, 1891. | New York. | No. 1.

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BUSY MEN

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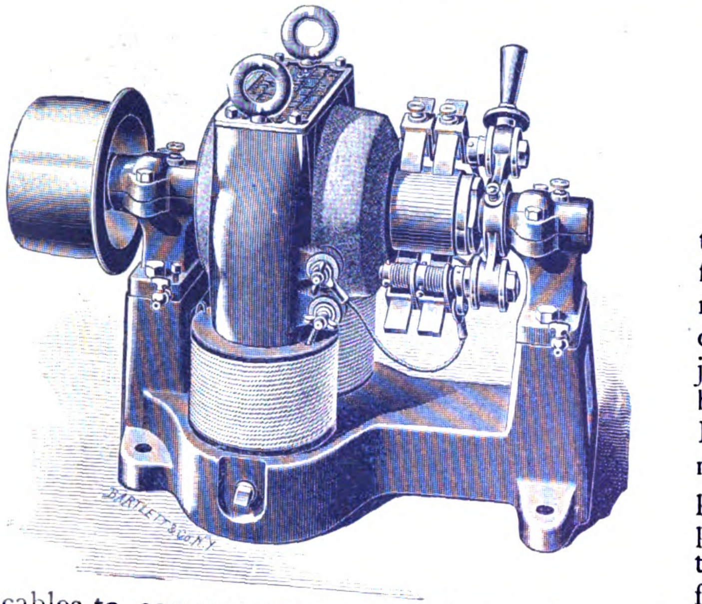

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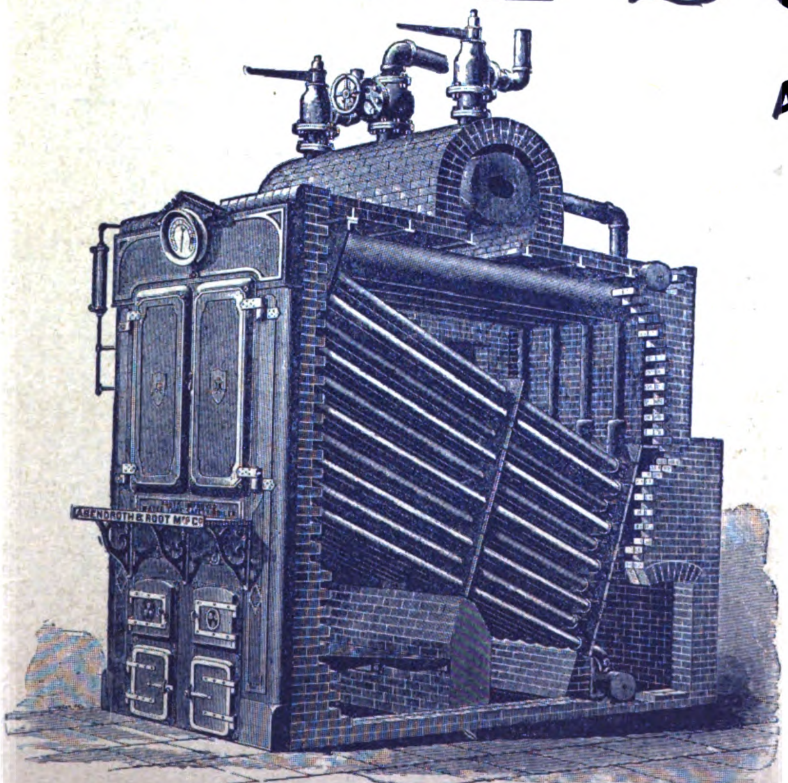

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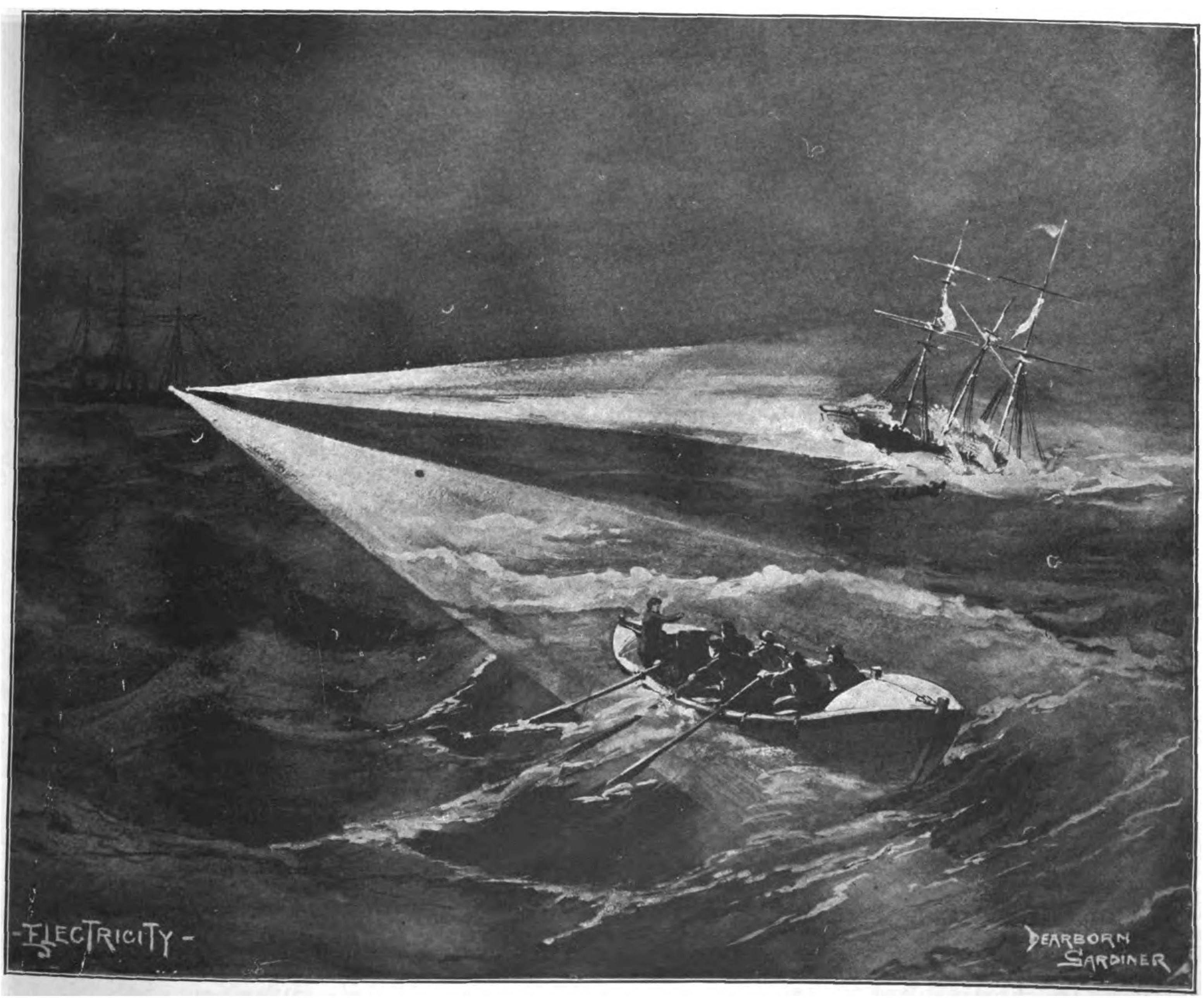


ELECTRIC SEARCH LIGHT ON SHIPBOARD.

ELECTRIC SEARCH LIGHT ON SHIPBOARD.

Few pretentious ships built within the last five or six years, whether men-of-war or ocean steamers, are today unprovided with the electric light, and the electric light is of inestimable benefit, both below deck and above, to those who go down to the sea in ships. Very great strides have been made of late years in the improvement and use of projectors, or search lights, one or more of which should certainly be carried by every steamer engaged in ocean traffic.

Of course it goes without saying that projectors have become practically indispensable in the equipment of a modern war ship. Not only are the powerful beams of light which they furnish of great assistance in signaling and in entering difficult harbors at night, but they constitute a very valuable element of defence against torpedo attacks, and even against large vessels. A British naval officer in a paper on the subject of harbor defence, or ships *versus* forts, recently gave expression to the opinion that less expenditure on big guns and a little more on large search lights would be distinctly advantageous. He instanced what would be the utter bewilderment of the captain of an ironclad endeavoring to force a narrow passage at night-time in the glare of a half dozen well-handled projectors. An accidental but very valuable testimony to the value of the search light as a means of defence was given only a month or two ago by the loss in Cherbourg harbor of the French torpedo-boat "Edmond Fontaine," which was run down by a cruiser whose captain was dazzled by the rays of a search light.

It is not the intention here, however, to expatiate particularly on the search light as an instrument of war on land or at sea, but more particularly to refer to its value in times of peace, when by its use fearful catastrophes might be prevented or their effects lessened. The terrible loss of life which occurred quite recently in Gibraltar bay, when the emigrant ship Utopia was lost, would undoubtedly have been far greater had it not been for the fact that all the vessels of the British squadron were well provided with search lights. The powerful rays of light were concentrated on the spot where the ill-fated steamer sank, and the work of rescuing the struggling unfortunates, who were battling for life with the angry waters, was carried on as if by daylight. If there had been no electric light many of those saved would certainly have been passed by and the death-roll would have numbered many more victims than it did.

There is no doubt that if every large passenger steamer was provided with several search lights many dangers would be avoided and the yearly loss of life at sea would be greatly lessened. This statement applies specially to emigrant steamers, in which so many lives are in jeopardy in times of danger. It has been recommended that the equipment of such vessels with search lights should be made compulsory by the governments of the countries under whose flags they sail and at whose ports they touch.

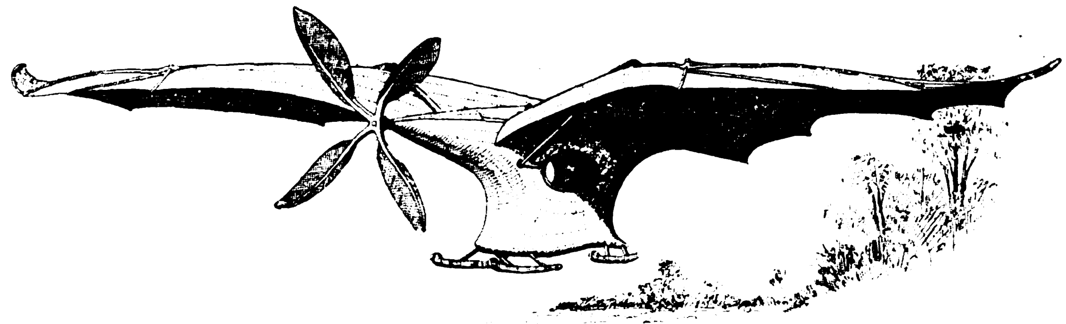
In foggy weather the search light forms a far more reliable indication of a ship's whereabouts than the gruff tones of the fog-horn or whistle. Thrown up towards the sky the beam is discernable at a considerable distance, and by the angle which it forms with the surface of the water, the direction in which the ship is steaming is made plain.

Within recent years great improvements have been effected in the construction of projectors. Their efficiency has been increased so that a more powerful light is obtained with a given current, and the mechanical part of the lamp has been so much improved that the greatest simplicity in working is obtained. Formerly it was necessary to regulate a projector by hand, the lamp needing continual attention to maintain a good light and project it in the desired direction. Now all this is effected automatically and a whole battery of search-lights can be manœuvred by the captain of the vessel from the bridge or conning tower by simply pressing a key or turning a switch.

As an instance of the simplicity of a search-light outfit, and the advantageous use to which it can be put, it is only necessary to look to the navigation of the Suez canal. Vessels unprovided with the electric light can hire a complete plant when entering the canal either at Suez or Port Said. The whole arrangement can be set up in an hour or two and the steamer can then go through the canal at night. Formerly every ship in the canal had to tie up to the banks at night and the passage often occupied 50 or 60 hours. Now it is generally made in 18 or 20 hours and on some occasions even quicker time has been made.

ADER ELECTRIC FLYING MACHINE.

Few persons have confidence in any form of flying machine, and the fact is not singular. If the predictions of the exploiters of air ships made not longer ago than a year had been realized, aerial craft would now be plying regularly between Chicago and New York. Of late there has seemed to be a revival of interest in schemes for navigating the air, and persons of no less standing than Prof. Langley and Maxim of gun fame have been quoted as saying that they believed that the problem would be satisfactorily solved. As has been said, few persons have confidence in flying machines, but as M. Adder asserts he has flown in his ship, and as he is a man of international reputation, it seems necessary to believe the statement, although it is not easy to see just how he accomplished the feat.



Ader Electric Flying Machine.

Air ships can be made to fly, and they can be steered. That was proved in the Exposition building in Chicago a few months ago by the owners of a flying ship, who gathered in quite a few dollars from the gullible public. But that ship, while it was an interesting toy, gave no more evidence of solving the problem of aerial navigation than Jonah's experience disclosed the secret of submarine navigation. Had the Chicago air-ship been turned loose in the open air instead of in the closed building, the gentlest zephyr would have ended its career. The power that propelled it was not more than one thirty-second of a horse-power, and its buoyancy was such that had a monkey wrench been attached to the car it never would have left the ground. This last statement is made on the authority of a Chicago electrical expert. The accumulators which supplied current to the motor in the car, remained on the ground.

The cut shows a form of air-ship which is of interest and worthy of attention because it was designed by Ader, of Paris, famous the world over, for his electrical apparatus. Ader's ship, as the picture shows, is built on the old idea of following the general outline of a bird. He says that he has flown in the craft several hundred feet at a height of 50 or 60 feet above the ground. He has steered the ship without trouble, he says. He was obliged to descend then because the accumulators which supplied current for his motor were exhausted.

The wings of the craft have a spread of about 50 feet. The frame is wicker and is covered with silk. The propeller, as the cut shows, is in front.

CONDITIONS OF TRADE.

The recent failure of the Empire City Electric Company, following the collapse of some smaller concerns, has afforded a fruitful text for prophets of evil, and has likewise furnished the key note for a good deal of sensible discussion as to the general condition of the electrical trade.

"We are going through a sort of a settling process," said the manager of a leading supply house the other day. "It comes about very naturally and will result in a net gain. The rapid growth of business in the electrical line, its enormous volume, and the large profits paid in the earlier days brought into the field a good many concerns with big notions and slender working capital. There has been too much banking on the future. Competition has naturally brought prices down. Short-sighted business methods have reduced prices on some goods away below the point of fair profit. The volume of trade is satisfactory and it will continue to increase. Opportunities for the employment of capital and brains in electrical enterprises are to be found on all sides. But it takes sound financiering and able business management to win nowadays in any line of trade. I look for better prices in the near future without relying on the formation of any combination. If there is a trust to be formed, I'm not 'in it'."

STORAGE BATTERY VEHICLES.

Several papers have lately been discussing the application of storage batteries to ordinary carriages and wagons, and the New York *Herald*, in one of its leading editorials recently, speaks with confidence of the day when vehicles drawn by horses shall disappear from the streets. Why not? A good start has been made. The street car horse is rapidly losing his occupation, and a few electric carriages have already made their appearance. The Sultan of Turkey rides about in a storage battery cart, or at least used to do so, and the time will come, doubtless, when even common folks can afford to enjoy such a privilege. The first general application will doubtless be made with tricycles. There are a host of persons longing for the day when such a machine can be purchased. Electric tricycles have already been made. Mr. Slattery, of the Fort Wayne Company, once rigged up a tricycle with motor and storage battery, and enjoyed many a pleasant ride, it is said. There were persons who were mean enough to comment on his unwillingness to employ the ordinary power for tricycle propulsion, but their criticisms did not interfere with his pleasure. Mr. Bain, of Chicago, proposes to design a machine of this kind when he finds time. An Eastern inventor writes to Electricity that he has an electric carriage which will soon be completed. If the Serpollet steam carriage which operates in Paris can be deemed successful, there certainly should be a chance for the electric carriage.

ELECTRICITY

POPULAR — PRACTICAL — TECHNICAL.

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Communications relating to subjects within the province of this journal are cordially invited. News notes, descriptions of new devices with drawings or photographs, are at all times desired.

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ELECTRICITY.

WITH this number we begin the publication of ELECTRICITY, a weekly journal devoted to the advancement of electrical interests. In adding another to the already considerable list of electrical periodicals, we should, perhaps, state the reasons which have led us to believe that a demand exists for a new journal in the field. We believe that an electrical paper should have a popular side and that it should contain matter of a practical character, as well as articles of a purely technical nature. We do not undervalue in the least the importance of technical literature, but we assert that a large class deeply interested in electrical work is unable to follow it in all its intricacies. Our policy will be sufficiently comprehensive to recognize the claims of this class, while we shall publish a large amount of strictly scientific and technical matter. We will endeavor, therefore, to make ELECTRICITY popular and practical, as well as merely technical and theoretical. Although published in Chicago, the paper will be neither in name nor in field merely a Western periodical. The East will be thoroughly covered. In New York an experienced editor will be located. The services of a large number of special writers have been secured, who will, from time to time, contribute to the columns of the paper. A staff of correspondents will send weekly letters from the principal news centers. The paper will be profusely illustrated. In short, ELECTRICITY will be the most readable, and the handsomest electrical journal published, if time, money and persistent effort will effect the result.

* * *

THERE is published in this issue a brief description of a newspaper man's visit to the Edison Laboratory. The writer is connected with the New York press, and his account is presented in an enthusiastic reportorial style. We ordinarily describe the productions of an electrical factory in a much more somber fashion, and the change may be, if not so learned, perhaps fully as agreeable. The kinetograph, which is described somewhat in detail, is certainly an exceedingly interesting device. Allowing a little, perhaps, for the enthusiasm of the writer, the general description may be accepted as correct. Mr. Edison's marvelous mechanical ingenuity, and exceptional mechanical appliances seem to have overcome many of the difficulties which other experimenters have experienced in designing an apparatus for photographing moving objects. In other words, all accounts indicate that his pictures are reproduced without jerks. It would seem that a great difficulty will be met when an attempt is made to reproduce sounds by the phonograph to accompany the reproduction of scenes. Apparently synchronism will be hard to maintain. The kinetograph, however, promises to be a profitable piece of apparatus and ought to be a money-making device when it reaches such a point of development that the nickel-in-the-slot principle can be applied.

* * *

IN view of the recent decision of Judge Wallace in the incandescent lamp suit an article on "An Object Lesson in an Electric Light Suit," which appears elsewhere in this issue, is especially timely.

In order that he might be in a position to consider the case intelligently Judge Wallace required quite a fund of information in relation to the prior state of the art, and the present principles of incandescent lamp manufacture. The apparatus exhibited, and the descriptions presented are reproduced substantially in the illustrations and article published this week. A perusal of the decision in the lamp suit, of which we publish a synopsis this week, shows that the court was greatly impressed by the "Object Lesson." In regard to the decision itself, it may be said to be an unqualified endorsement of Edison's claim that he is the inventor of the practical incandescent electric lamp.

* * *

WE ought perhaps to add our protest against the use of the word "electrocute," which is as hideously barbarous as the thing which it designates. The combination of the Greek and Latin elements forms a word which must be extremely objectionable even to persons who are not purists. Still it must be admitted that it is an easy word to speak, and as unfortunately a need exists for a designating term, we may have to put up with it, barbarism though it is. One is reminded of the word cablegram, against the use of which there was such bitter opposition; yet the word has a firm enough place in the English language to-day. "Electrocute" has undoubtedly been generally adopted by the daily press, and while it has been added to the *index expurgatorius* by a number of influential journals, we fear that their violent protests will be without avail.

* * *

IN an article on "Industrial and Financial Co-operation," F. B. Thurber in one of the recent reviews speaks of the increasing tendency of business houses to incorporate, and to co-operate. The underlying causes to which the increased activities of co-operation are chiefly attributable, are undoubtedly, according to Mr. Thurber, steam, electricity and machinery. The statement of course is true, and examples of the tendency toward consolidation and co-operation are not wanting in the electrical world. It is an interesting fact to note that while in the manufacture of electrical machinery the tendency may be toward consolidation, in its utilization the reverse may be true. It has been noted heretofore that the distribution of power by electricity is so conveniently and economically effected that many persons now conduct small manufacturing establishments, where before the introduction of the electric motor, they would be gathered at a central point as employes of a large factory where power was available. A number of writers on economic subjects have expressed their belief that in certain lines of manufacture, the introduction of the electric motor will work quite a significant change in industrial conditions, and they predict that the change will be one of advantage to the workmen.

* * *

A CONTRIBUTOR in another column makes the rather startling suggestion that power from Niagara Falls be electrically transmitted to Chicago, to operate motors in the Electrical Department of the World's Fair. If the Germans can transmit power from Lauffen to Frankfort-on the-Main, a distance of considerably over one hundred miles, why should Americans hesitate to undertake a still greater engineering feat? This is the essentially American inquiry which the writer of the article propounds. Every electrician would feel a proper pride in his calling should such an enterprise be undertaken. No American certainly would be willing to admit that if the Germans can accomplish their great feat of transmission next month, electrical engineers on this side of the water are unable to carry to success the project which our contributor suggests. The idea may not commend itself to those in charge of the Electrical Department, but we would be extremely glad if it should lead to the suggestion of other enterprises which may enhance the interest of the electrical exhibit. If the German undertaking proves successful the Frankfort Exposition will have a prominent place in electrical history. The World's Fair in 1893 should be equally memorable. The Electrical Department should be attractive, not merely as a fine display of electrical machinery. It should, we think, give a striking illustration of what American electrical engineers are able to achieve. The transmission of power principle will perhaps be so well shown at Frankfort that anything of a similar character, even for a far greater distance, may be regarded as an imitation. For this reason, if for no other, the Niagara Falls suggestion may be considered objectionable. The general idea that some great feat in electrical engineering should be undertaken in connection with the department we think is well worthy of the attention of the managers, and it is commended to their serious consideration.

* * *

THE electric railway system of Cincinnati has attracted more attention than that of any city in the country for reasons which Nelson W. Perry discusses in an article published elsewhere in this number. The fact that double trolley systems and single trolley lines run on the same track in several instances, causes a number of interesting conditions, and the possibilities are pointed out by Mr. Perry. The article is the more interesting when it is remembered that the double trolley was first in the field, and was generally discarded, but was adopted under protest in Cincinnati, where it is now regarded with no little favor.

AN OBJECT LESSON IN AN ELECTRIC LIGHT SUIT.

One of the most interesting features of the recent suit of the Edison Electric Light Company against the United States Electric Lighting Company, brought to recover for alleged infringement of incandescent lamps, was a series of illustrations specially designed to give Judge Wallace, of the District Court, a clearer idea of electrical units.

Among other things a board was prepared for representing the effect which length and cross-

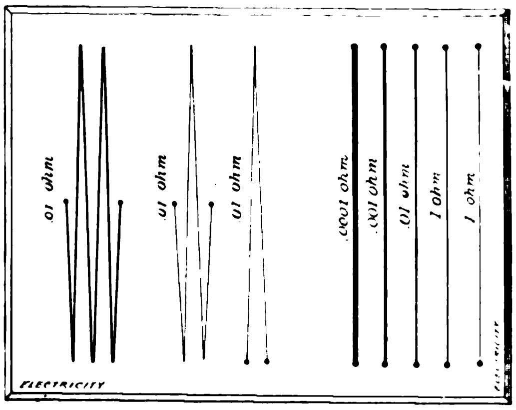

FIG. 1.

sectional area in a conductor have upon the resistance of the conductor. This is illustrated in Fig. 1. To the left of the board are shown the lengths of wire of No. 14, No. 16 and No. 18 Brown & Sharpe gauge required to show a resistance of 1-100 ohm. To the right, in regular progression, are the No. 0, No. 10, No. 20, No. 30 and No. 40 Brown & Sharpe gauge wire, all of the same length. These show, at a glance, the effect which cross-sectional area will have on resistance. For instance, where one foot of No. 40 copper wire measure one ohm, one foot of No. 0 wire measures about 1-10,000 ohm.

Illustration No. 2: In the course of the argument the question of specific resistance in contradistinction to total resistance was one of constant recurrence. An exhibit was therefore devised to illustrate the relative resistance of copper, iron and carbon. Where ten feet of copper wire 1-100 inch in diameter measure one ohm it takes but 18 inches of iron wire of the same size to measure one ohm; and to show the immense difference in specific resistance between these metals and carbon it was shown that 4-100 of an inch of carbon of the same size as the wires was all that could be taken to measure the resistance.

Illustration No. 3: This exhibit was prepared

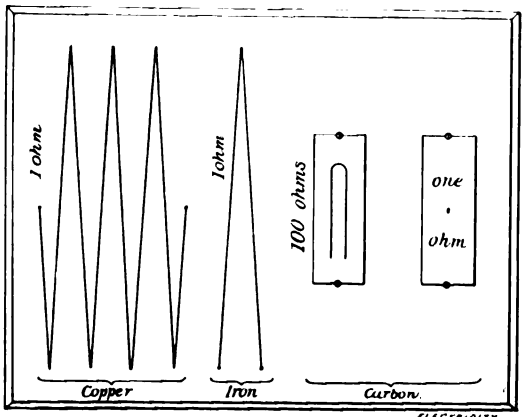

FIG. 2.

to illustrate the different steps in the process of manufacture through which the Edison lamp passes on its course towards completion. The globe, 1, is the article as it comes from the lamp factory; Nos. 2 and 3 are different sized glass tubes; No. 4 is a strip of bamboo, as received from Japan. These four articles are all what might be termed raw material. No. 5 is the thin filament of bamboo before carbonization. No. 6 is No. 1 with the projection punched into shape at the top. No. 7, the next step, shows No. 6 with the bottom of the tube reamed out, and with the small tube, No. 3, attached at the top. No. 8 shows the two leading-in wires of platinum with copper wires attached. No. 9 is the rod 2 with a small bulb blown in it. No. 10 shows the last step, with the leading-in wires sealed in a tube. No. 11 shows this "inside part" with the carbon filament attached ready to be inserted in globe 7. No. 12 shows this insertion as accomplished, with the two glass parts fused together. No. 13 is No. 12 with the unnecessary projections taken off at the bottom. The lamp is now ready for the pump. No. 14 shows the exhausted lamp as it leaves the pump room, where all the air has been extracted from the interior. No. 15 is the finished product.

Illustration No. 4: The improvement was referred to in the suit of a combination in an incandescent lamp of high resistance in proportion to the radiating surface. To show this plainly to the judge three lamps, each of the same resistance, and having radiating surfaces of 1 to 6 to sixteen, were placed in series and connected to

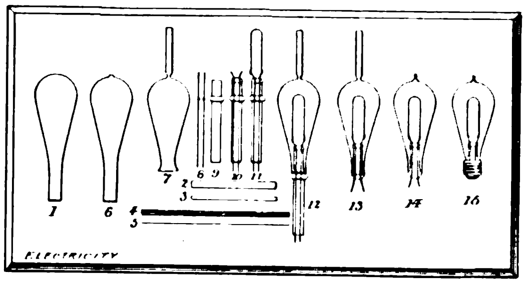

FIG. 3.

a battery of 24 Bunsen cells. Although the same current necessarily traveled over each lamp, the lamp having the least radiating surface gave a brilliant light, while the lamp with the largest amount of radiating surface was hardly brought to a dull red.

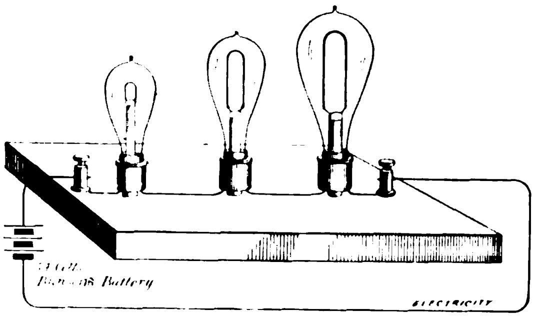

FIG. 4.

Illustration No. 5: The Edison counsel contended that prior to Mr. Edison's discovery of the light of the patent in suit, and its publication, no practically commercial lamp had ever been produced. Among the points brought in substantiation of this claim were the experiments made by Fontaine in 1878-9, in which it was found that when lamps having low resistance and large radiating surfaces were connected to a Bunsen battery, by turning one lamp on a brilliant light could be obtained. When two of these lamps in multiple arc were turned on at the same time the light produced by the two lamps was not equal to that thrown out originally by the first lamp, but dropped down very low; in fact, where one lamp might give 25 candle power the two lamps in multiple arc would not give a total of 20 candle power. As more lamps were turned on the light would diminish rapidly, until it was found that when five were in circuit the carbons of all could hardly be distinguished by the light they gave. Fontaine was looking for practical means of subdividing the large lights which were obtainable in his day into small units without corresponding loss. This he demonstrated to his own satisfaction and that of the world at large to be an impossibility, as shown by the mathematical verification given to his deductions by W. H. Preece and others. This experiment was shown to the judge, just as Fontaine tried it, with the results indicated in his reports.

On the same board with the Fontaine lamps, and fed from the same battery five Edison filamentary lamps having high resistance and low radiating surface were exhibited, and it was found that the five lamps could be turned on

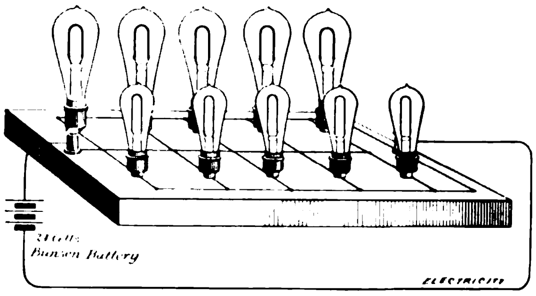

FIG. 5.

at the same time without any diminution in the candle power of any, so that the light given out by the last lamp turned on was the same as that of the first. This experiment showed that although the unit of light on each of these high resistance lamps was only six candle power, as compared with 25 candle power in the Fontaine experiments, the subdivision of the 25 candles of light was accomplished by means of the Edison lamps without loss.

Illustration No. 6: What seemed to strike the lawyers for the defense as a remarkably strong argument was exhibit 6, showing the relative sizes of conductors required for the lamps known prior to Edison's time and the lamps described in his patent. At the top of the board were arranged an old style "rod" carbon, a 50-volt lamp and a 110-volt lamp, the last two having filamentary carbons. It was shown that to feed one hundred of the 110-volt Edison lamps at a distance of 100 feet with 2 per cent. loss, a No. 4 Brown & Sharpe gauge wire would be necessary. To feed the same number of 50-volt lamps five of these No. 4 wires would be necessary; while to feed the same number of the lamps known prior to Edison's patent would require four hundred of these No. 4 wires for each side of the circuit. The ratio between a 110-volt filamentary lamp and the 9-volt "rod" lamp is as one to four hundred, and where a foot of the conductor required for one might cost three cents, a foot of the other conductor would cost twelve dollars. What was

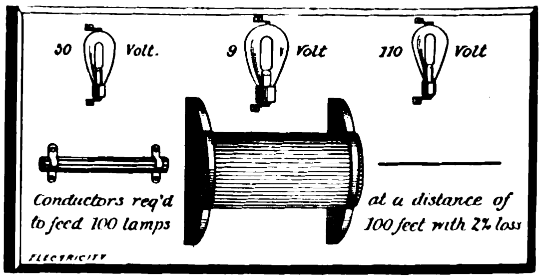

FIG. 6.

therefore a commercial failure was converted by Edison's improvements into a commercial success.

Sir James Kitson, who visited this country with the members of the Iron and Steel Institute, has a high idea of American manufacturers and American skilled labor. The latter, he says in a recent article, is the best in the world. The former, he says, display a remarkable readiness to adopt scientific methods and mechanical improvements in the process of manufacture. The statement is especially true as applied to the electrical industry.

EDISON IN HIS LABORATORY.

BY OSCAR K. DAVIS.

Nothing can be more interesting than to spend an hour or two with Edison in his laboratory. When he is in a mood for entertaining, as he was when I saw him, he is delightful; his talk is fascinating, and he charms one with the brilliancy and the daring of his undertakings. His schemes and plans are numbered by hundreds.

Mr. Edison promised one day to show me the working model of the kinetograph, his latest success, and I went to his laboratory at Orange to see it. He was in high spirits on that occasion, and while we were waiting for the assistant who was in charge of the model to make arrangements about the power, Mr. Edison showed me several rolls of gelatine film which he uses in the kinetograph. He talked freely of his machine, and traveled off frequently into others of his pet schemes. There were a number of things which he spoke about, but these four made the greatest impression upon me at the time: The kinetograph, his cosmical telephone, his iron mining scheme, and his plan for photographing in the dark. Of the kinetograph I wrote a very full description for the *Sun*, and a great deal has since been printed about it. It is worth a great deal more, but the limits of this article will not permit an extended notice of perhaps the most marvelous of all his wonderful inventions.

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Among other things a board was prepared for representing the effect which length and cross-sectional area in a conductor have upon the resistance of the conductor. This is illustrated in Fig. 1. To the left of the board are shown the lengths of wire of No. 14, No. 16 and No. 18 Brown & Sharpe gauge required to show a resistance of 1-100 ohm. To the right, in regular progression, are the No. 0, No. 10, No. 20, No. 30 and No. 40 Brown & Sharpe gauge wire, all of the same length. These show, at a glance, the effect which cross-sectional area will have on resistance. For instance, where one foot of No. 40 copper wire measure one ohm, one foot of No. 0 wire measures about 1-10,000 ohm.

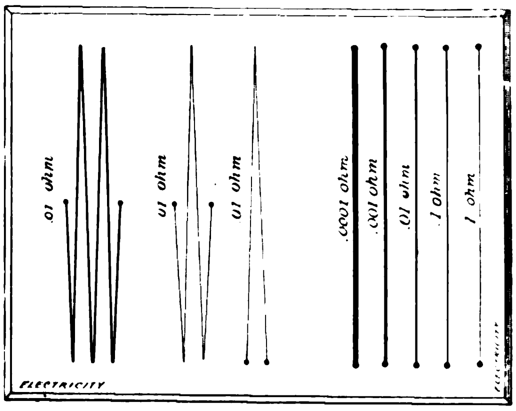

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Illustration No. 2: In the course of the argument the question of specific resistance in contradistinction to total resistance was one of constant recurrence. An exhibit was therefore devised to illustrate the relative resistance of copper, iron and carbon. Where ten feet of copper wire 1-100 inch in diameter measure one ohm it takes but 18 inches of iron wire of the same size to measure one ohm; and to show the immense difference in specific resistance between these metals and carbon it was shown that 4-100 of an inch of carbon of the same size as the wires was all that could be taken to measure the resistance.

Illustration No. 3: This exhibit was prepared to illustrate the different steps in the process of manufacture through which the Edison lamp passes on its course towards completion. The globe, 1, is the article as it comes from the lamp factory; Nos. 2 and 3 are different sized glass tubes; No. 4 is a strip of bamboo, as received from Japan. These four articles are all what might be termed raw material. No. 5 is the thin filament of bamboo before carbonization. No. 6 is No. 1 with the projection punched into shape at the top. No. 7, the next step, shows No. 6 with the bottom of the tube reamed out, and with the small tube, No. 3, attached at the top. No. 8 shows the two leading-in wires of platinum with copper wires attached. No. 9 is the rod 2 with a small bulb blown in it. No. 10 shows the last step, with the leading-in wires sealed in a tube. No. 11 shows this "inside part" with the carbon filament attached ready to be inserted in globe 7. No. 12 shows this insertion as accomplished, with the two glass parts fused together. No. 13 is No. 12 with the unnecessary projections taken off at the bottom. The lamp is now ready for the pump. No. 14 shows the exhausted lamp as it leaves the pump room, where all the air has been extracted from the interior. No. 15 is the finished product.

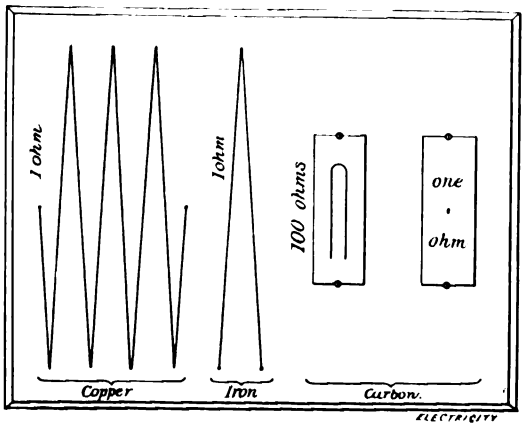

FIG. 2.

Illustration No. 4: The improvement was referred to in the suit of a combination in an incandescent lamp of high resistance in proportion to the radiating surface. To show this plainly to the judge three lamps, each of the same resistance, and having radiating surfaces of 1 to 6 to sixteen, were placed in series and connected to a battery of 24 Bunsen cells. Although the same current necessarily traveled over each lamp, the lamp having the least radiating surface gave a brilliant light, while the lamp with the largest amount of radiating surface was hardly brought to a dull red.

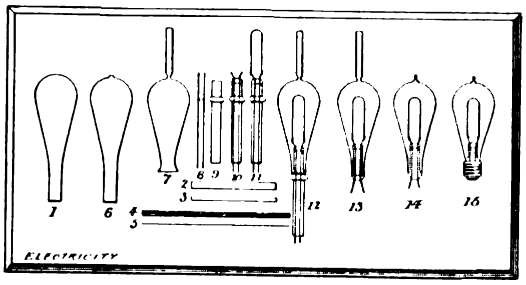

FIG. 3.

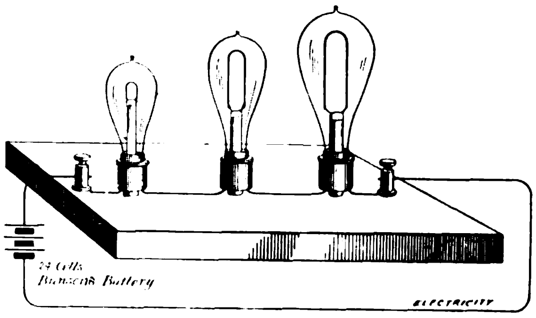

FIG. 4.

Illustration No. 5: The Edison counsel contended that prior to Mr. Edison's discovery of the light of the patent in suit, and its publication, no practically commercial lamp had ever been produced. Among the points brought in substantiation of this claim were the experiments made by Fontaine in 1878-9, in which it was found that when lamps having low resistance and large radiating surfaces were connected to a Bunsen battery, by turning one lamp on a brilliant light could be obtained. When two of these lamps in multiple arc were turned on at the same time the light produced by the two lamps was not equal to that thrown out originally by the first lamp, but dropped down very low; in fact, where one lamp might give 25 candle power the two lamps in multiple arc would not give a total of 20 candle power. As more lamps were turned on the light would diminish rapidly, until it was found that when five were in circuit the carbons of all could hardly be distinguished by the light they gave. Fontaine was looking for practical means of subdividing the large lights which were obtainable in his day into small units without corresponding loss. This he demonstrated to his own satisfaction and that of the world at large to be an impossibility, as shown by the mathematical verification given to his deductions by W. H. Preece and others. This experiment was shown to the judge, just as Fontaine tried it, with the results indicated in his reports.

On the same board with the Fontaine lamps, and fed from the same battery five Edison filamentary lamps having high resistance and low radiating surface were exhibited, and it was found that the five lamps could be turned on at the same time without any diminution in the candle power of any, so that the light given out by the last lamp turned on was the same as that of the first. This experiment showed that although the unit of light on each of these high resistance lamps was only six candle power, as compared with 25 candle power in the Fontaine experiments, the subdivision of the 25 candles of light was accomplished by means of the Edison lamps without loss.

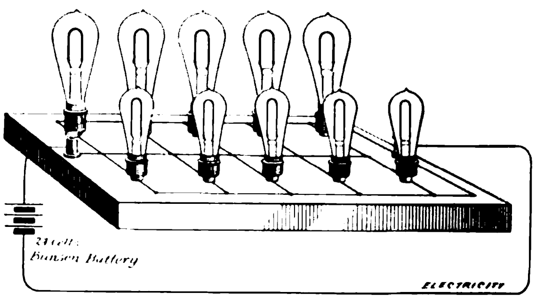

FIG. 5.

Illustration No. 6: What seemed to strike the lawyers for the defense as a remarkably strong argument was exhibit 6, showing the relative sizes of conductors required for the lamps known prior to Edison's time and the lamps described in his patent. At the top of the board were arranged an old style "rod" carbon, a 50-volt lamp and a 110-volt lamp, the last two having filamentary carbons. It was shown that to feed one hundred of the 110-volt Edison lamps at a distance of 100 feet with 2 per cent. loss, a No. 4 Brown & Sharpe gauge wire would be necessary. To feed the same number of 50-volt lamps five of these No. 4 wires would be necessary; while to feed the same number of the lamps known prior to Edison's patent would require four hundred of these No. 4 wires for each side of the circuit. The ratio between a 110-volt filamentary lamp and the 9-volt "rod" lamp is as one to four hundred, and where a foot of the conductor required for one might cost three cents, a foot of the other conductor would cost twelve dollars. What was therefore a commercial failure was converted by Edison's improvements into a commercial success.

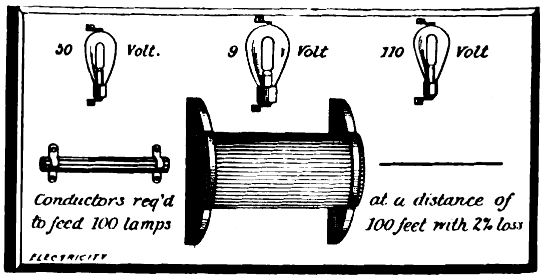

FIG. 6.

Sir James Kitson, who visited this country with the members of the Iron and Steel Institute, has a high idea of American manufacturers and American skilled labor. The latter, he says in a recent article, is the best in the world. The former, he says, display a remarkable readiness to adopt scientific methods and mechanical improvements in the process of manufacture. The statement is especially true as applied to the electrical industry.

EDISON IN HIS LABORATORY.

BY OSCAR K. DAVIS.

Nothing can be more interesting than to spend an hour or two with Edison in his laboratory. When he is in a mood for entertaining, as he was when I saw him, he is delightful; his talk is fascinating, and he charms one with the brilliancy and the daring of his undertakings. His schemes and plans are numbered by hundreds.

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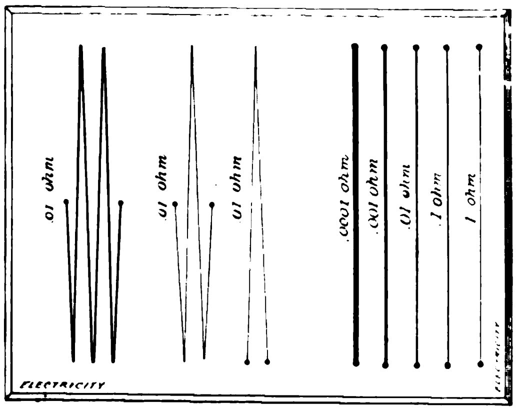

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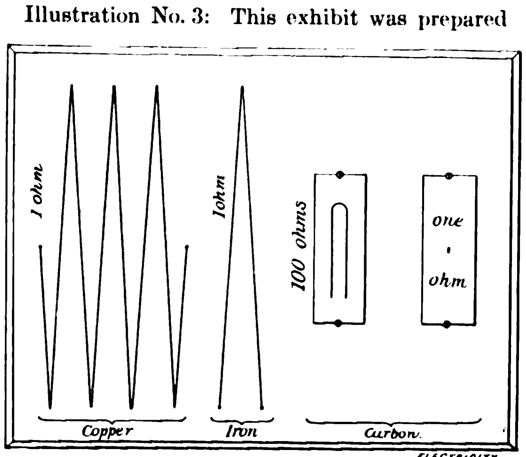

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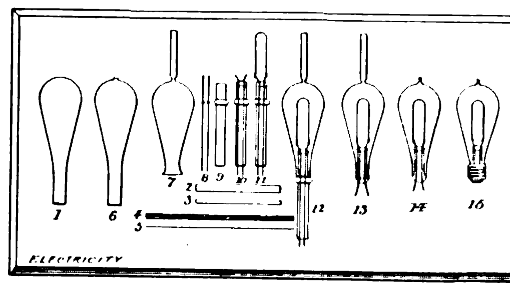

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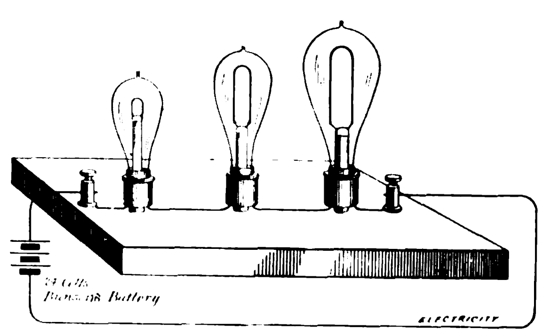

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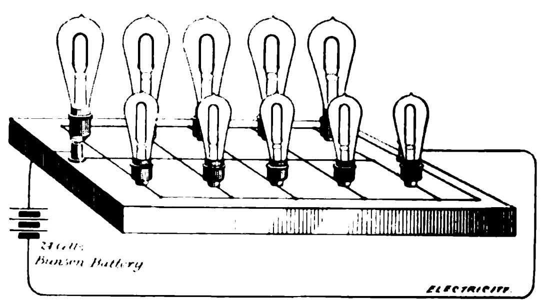

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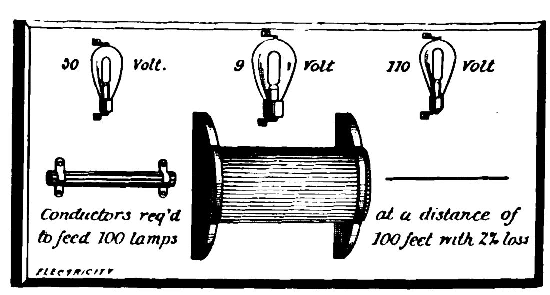

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Sir James Kitson, who visited this country with the members of the Iron and Steel Institute, has a high idea of American manufacturers and American skilled labor. The latter, he says in a recent article, is the best in the world. The former, he says, display a remarkable readiness to adopt scientific methods and mechanical improvements in the process of manufacture. The statement is especially true as applied to the electrical industry.

EDISON IN HIS LABORATORY.

BY OSCAR K. DAVIS.

Nothing can be more interesting than to spend an hour or two with Edison in his laboratory. When he is in a mood for entertaining, as he was when I saw him, he is delightful; his talk is fascinating, and he charms one with the brilliancy and the daring of his undertakings. His schemes and plans are numbered by hundreds.

Mr. Edison promised one day to show me the working model of the kinetograph, his latest success, and I went to his laboratory at Orange to see it. He was in high spirits on that occasion, and while we were waiting for the assistant who was in charge of the model to make arrangements about the power, Mr. Edison showed me several rolls of gelatine film which he uses in the kinetograph. He talked freely of his machine, and traveled off frequently into others of his pet schemes. There were a number of things which he spoke about, but these four made the greatest impression upon me at the time: The kinetograph, his cosmical telephone, his iron mining scheme, and his plan for photographing in the dark. Of the kinetograph I wrote a very full description for the *Sun*, and a great deal has since been printed about it. It is worth a great deal more, but the limits of this article will not permit an extended notice of perhaps the most marvelous of all his wonderful inventions.

The kinetograph is a machine to record and reproduce motion exactly as the phonograph records and reproduces sound. It seems incredible, but it is a fact. When I went into Mr. Edison's laboratory I was prepared to see a gigantic "fake" exploded. But the "fake" turned out to be a fact, and I stayed to marvel at the ingenuity and the simplicity of the thing. The trouble in understanding the kinetograph is with our conceptions of photographs. The main idea of a photograph is that the position of the subject is fixed. An instantaneous photograph of a man making a running high jump may show him just clearing the bar; look at the view for a week, and the jumper is still just clearing the bar. If a kinetograph had taken the picture, and you saw it reproduced, you would see the jumper set his teeth and contract his muscles, watch him run and spring up, see the strained expression of his face as he lifted himself over the bar, and note the relaxation as he fell when he had cleared it.

How is it all done? By means of a little box camera with revolving shutters, which are worked by electric power so rapidly that they will open and close 46 times a second. Behind the shutters runs a roll of highly sensitized gelatine film. There is an arrangement which stops the film when the shutters open, and this little box camera takes 46 perfect photographs in one second. The variation in the motion or expression of the photographed subject is so very slight between any two consecutive views as to be almost imperceptible while looking at the strip; but if the continuous photographs be reproduced by a projecting lens as rapidly as they were taken the effect is to reproduce pure motion. The reproduction is a detail. It was the taking of the pictures at that phenomenal rate of speed that gave Edison the trouble. That is what he calls the "germ" or "base principle" of his machine.

He laughed while talking about it, and was as pleased as a boy with a new red wagon. "I'll fix it," he said, "so that you can see Carmencita dance in your own parlor or hear Patti sing. You can see Chauncey Depew come out to introduce a speaker at a public meeting. He will walk up to the front of the stage, take a drink of water, bow and smile and start off with his oration. Just the same thing with an opera. See them all life size on the screen and hear them crack their jokes. Seem kind of funny to hear Wilson sing

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He enjoys a good story hugely, and tells one himself with rare gusto. He told me one that afternoon about a new-fangled kodak which he saw in an up-country Pennsylvania town one Sunday. He had been out to see some iron works in a cold rain storm and was drenched and chilled through. When he reached his hotel he asked for a hot Scotch.

"Can't give it to you," said the clerk.

"Can't give it to me? Why not?"

"Because it's Sunday. We can't sell anything on Sunday."

"I remonstrated with him," said Edison, in telling the story. "I told him I was cold and wet and wanted a drink."

"Well, I'll tell you what we can do," he said; "we can give you a kodak."

"What is a kodak?" I asked.

"You go up to your room and press the button. We do the rest."

"I got the drink." And Edison laughed at the recollection.

His account of his cosmical telephone was as amusing as it was interesting. It is not generally known that Edison is a mine owner; but he is. He probably has control of more iron mines than any other man in America, and there is a characteristic story about him in that fact. His mines are all of magnetic ore. The largest one is at Ogden, N. J., and there he has put up his cosmical telephone. He estimates that he has 2,000,000,000,000 tons of magnetic ore in one bunch at Ogden. There is an enormous intensification of magnetic forces of the earth at that point. He has fenced the whole thing in with telegraph poles on which he has strung a fifteen-wire copper cable. At the end of the cable he has placed a regular telephone receiver. The disturbances of the sun's spots cause a variation in the magnetic forces of the earth, which he says will be recorded by his cosmical telephone.

"I'm going to hear what goes on up there now," he says. "The next time 600,000 miles of hydrogen go shooting out into space I'm going to hear all about it. There are the most tremendous things going on up there all the time. Fearful they are, sometimes. You can see them every day with my telescope."

I asked him how he came to be smelting iron and he told me. It struck him one day that the iron in the magnetites which were lying all over New Jersey unused, because the common process of smelting was too expensive, could be separated by means of a magnet. He broached the scheme to several big iron men and they laughed at him. Then he formed a company with his own laboratory boys. They put up a stamp mill at Ogden and an eight-ton magnet. The crushed ore falls from a hopper above the magnet. The magnet deflects the trajectory of the fine particles of iron so that they fall inside a partition, while the refuse falls outside of it. The iron men want to be "in it" now, he says, "but they can't come in. There isn't room."

"I leased every bed of magnetites this side of Michigan," he said, "and they can't get a place to work. I'm going to wipe those Lehigh Valley fellows off the face of the earth."

Talking about photography, Mr. Edison told of the queerest scheme of them all. "I don't see," he said, "why a man can't photograph in the dark just as well as in the light. It seems to me that it ought to be possible to take photographs by a heat radiant just as well as by a light radiant. Both radiants are the results of the vibrations of ether. Now, it seems as if I ought to get a plate sensitized to heat vibrations as well as to light. I've succeeded in getting a plate that was sensitive in a measure to heat, but not sufficiently to be practical. I can make a plate that will detect the presence of an animal body. Maybe I can't make it work, but I'm trying."

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The applications for space in the electrical building are coming in rapidly. Already 200,000 square feet have been asked for. The main floor has an area of only 243,000 square feet, without the gallery, which has an area of 95,000 square feet. The department reserves the right to cut down the space which exhibitors request, and it is doubtless true that many of them will find that they are not given as large an area as they have asked for. A great deal of extra space will be provided in the Machinery annex, and Architect Burnham guarantees that in this way he will find an abundance of room for those who wish to exhibit electrical apparatus.

* * *

All the applicants for space desire to make large exhibits. Secretary Hornsby states that no one who has applied thus far has expressed an intention of expending less than $5,000.

* * *

Nothing official can yet be stated in regard to the exhibition of foreign electrical apparatus. The department confidently expects that a num-

AN OBJECT LESSON IN AN ELECTRIC LIGHT SUIT.

One of the most interesting features of the recent suit of the Edison Electric Light Company against the United States Electric Lighting Company, brought to recover for alleged infringement of incandescent lamps, was a series of illustrations specially designed to give Judge Wallace, of the District Court, a clearer idea of electrical units.

Among other things a board was prepared for representing the effect which length and cross-

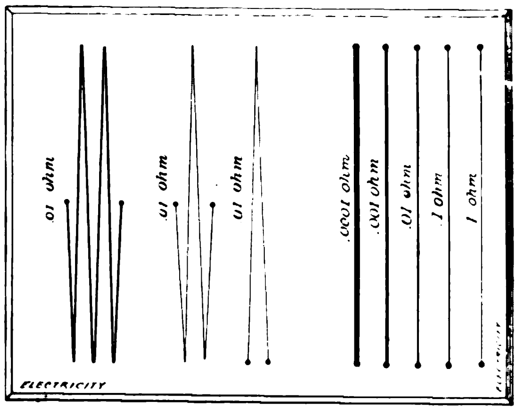

Fig. 1.

sectional area in a conductor have upon the resistance of the conductor. This is illustrated in Fig. 1. To the left of the board are shown the lengths of wire of No. 14, No. 16 and No. 18 Brown & Sharpe gauge required to show a resistance of 1-100 ohm. To the right, in regular progression, are the No. 0, No. 10, No. 20, No. 30 and No. 40 Brown & Sharpe gauge wire, all of the same length. These show, at a glance, the effect which cross-sectional area will have on resistance. For instance, where one foot of No. 40 copper wire measure one ohm, one foot of No. 0 wire measures about 1-10,000 ohm.

Illustration No. 2: In the course of the argument the question of specific resistance in contradistinction to total resistance was one of constant recurrence. An exhibit was therefore devised to illustrate the relative resistance of copper, iron and carbon. Where ten feet of copper wire 1-100 inch in diameter measure one ohm it takes but 18 inches of iron wire of the same size to measure one ohm; and to show the immense difference in specific resistance between these metals and carbon it was shown that 4-100 of an inch of carbon of the same size as the wires was all that could be taken to measure the resistance.

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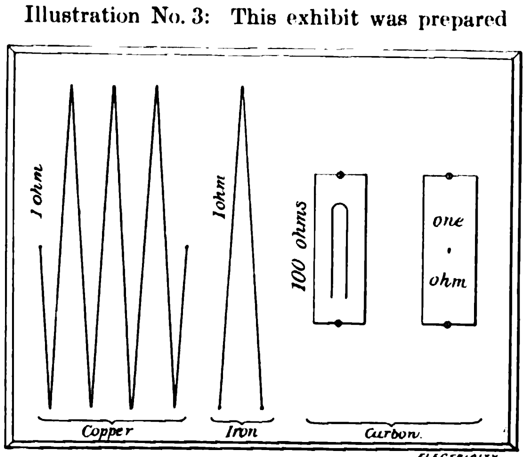

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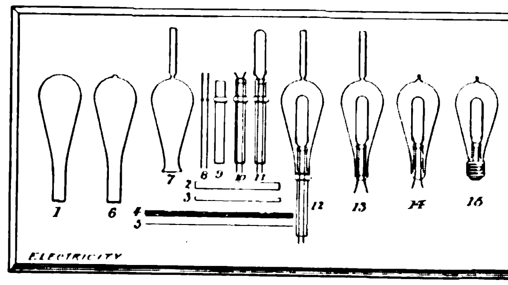

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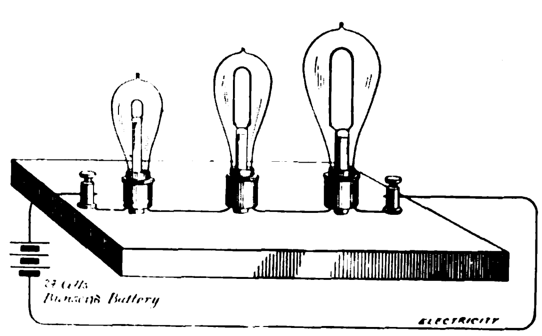

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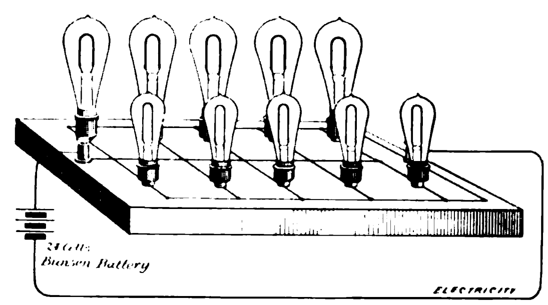

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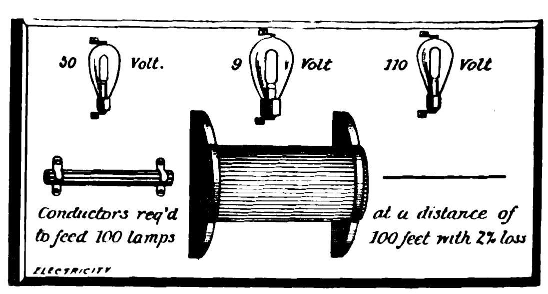

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"Can't give it to me? Why not?"

"Because it's Sunday. We can't sell anything on Sunday."

"I remonstrated with him," said Edison, in telling the story. "I told him I was cold and wet and wanted a drink."

"Well, I'll tell you what we can do," he said; "we can give you a kodak."

"What is a kodak?" I asked.

"You go up to your room and press the button. We do the rest."

"I got the drink." And Edison laughed at the recollection.

His account of his cosmical telephone was as amusing as it was interesting. It is not generally known that Edison is a mine owner; but he is. He probably has control of more iron mines than any other man in America, and there is a characteristic story about him in that fact. His mines are all of magnetic ore. The largest one is at Ogden, N. J., and there he has put up his cosmical telephone. He estimates that he has 2,000,000,000,000 tons of magnetic ore in one bunch at Ogden. There is an enormous intensification of magnetic forces of the earth at that point. He has fenced the whole thing in with telegraph poles on which he has strung a fifteen-wire copper cable. At the end of the cable he has placed a regular telephone receiver. The disturbances of the sun's spots cause a variation in the magnetic forces of the earth, which he says will be recorded by his cosmical telephone.

"I'm going to hear what goes on up there now," he says. "The next time 600,000 miles of hydrogen go shooting out into space I'm going to hear all about it. There are the most tremendous things going on up there all the time. Fearful they are, sometimes. You can see them every day with my telescope."

I asked him how he came to be smelting iron and he told me. It struck him one day that the iron in the magnetites which were lying all over New Jersey unused, because the common process of smelting was too expensive, could be separated by means of a magnet. He broached the scheme to several big iron men and they laughed at him. Then he formed a company with his own laboratory boys. They put up a stamp mill at Ogden and an eight-ton magnet. The crushed ore falls from a hopper above the magnet. The magnet deflects the trajectory of the fine particles of iron so that they fall inside a partition, while the refuse falls outside of it. The iron men want to be "in it" now, he says, "but they can't come in. There isn't room."

"I leased every bed of magnetites this side of Michigan," he said, "and they can't get a place to work. I'm going to wipe those Lehigh Valley fellows off the face of the earth."

Talking about photography, Mr. Edison told of the queerest scheme of them all. "I don't see," he said, "why a man can't photograph in the dark just as well as in the light. It seems to me that it ought to be possible to take photographs by a heat radiant just as well as by a light radiant. Both radiants are the results of the vibrations of ether. Now, it seems as if I ought to get a plate sensitized to heat vibrations as well as to light. I've succeeded in getting a plate that was sensitive in a measure to heat, but not sufficiently to be practical. I can make a plate that will detect the presence of an animal body. Maybe I can't make it work, but I'm trying."

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The applications for space in the electrical building are coming in rapidly. Already 200,000 square feet have been asked for. The main floor has an area of only 243,000 square feet, without the gallery, which has an area of 95,000 square feet. The department reserves the right to cut down the space which exhibitors request, and it is doubtless true that many of them will find that they are not given as large an area as they have asked for. A great deal of extra space will be provided in the Machinery annex, and Architect Burnham guarantees that in this way he will find an abundance of room for those who wish to exhibit electrical apparatus.

* * *

All the applicants for space desire to make large exhibits. Secretary Hornsby states that no one who has applied thus far has expressed an intention of expending less than $5,000.

* * *

Nothing official can yet be stated in regard to the exhibition of foreign electrical apparatus. The department confidently expects that a num-

ber of prominent electrical companies will consign machinery.

* * *

While no boilers or engines will be allowed in the Electricity Building, there will be no prohibition against the operation of electric motors. Dynamos, therefore, can be belted to motors, and the model plants can be shown in actual operation.

* * *

The exhibit of electric machinery will be made in connection with the Department of Mines and Mining. This has been decided by an agreement between Mr. Skiff, of the Mining Department, and Prof. Barrett, of the Electrical Department.

* * *

The *Black Diamond* suggests that the progress in mining should be illustrated "from the time that the old Pennsylvania Dutchman dug up the stone coal, to the advent of the electric cutter."

* * *

The executive committee of the Indiana World's Fair commission has decided that its display will be divided into six departments. Department E comprises "manufactures and machinery, including electricity and electrical appliances."

* * *

It makes one's mouth water to read this description of a World's Fair Building in the *Electrical Review:* "Completely surrounded by water, this structure, with its fleet of boats and numerous waterways, is expected to have a decidedly Venetian *flavor.*"

* * *

The Western Electric Company has asked for considerable space in the Electrical Building, but has not yet formed plans in regard to its exhibit.

* * *

Prof. Barrett, chief of the Department of Electricity, returned last Saturday from a trip of a few days. He stopped at Fort Wayne and Indianapolis where he talked with the electrical manufacturers. They said they were ready to do about all that he wished. Wherever the professor goes he finds the greatest interest taken in his section, and electrical manufacturers are willing to co-operate with him in every way. One of the National commissioners said yesterday that the public was manifesting more interest in the electrical section than in any other department, with the possible exception of that of fine arts.

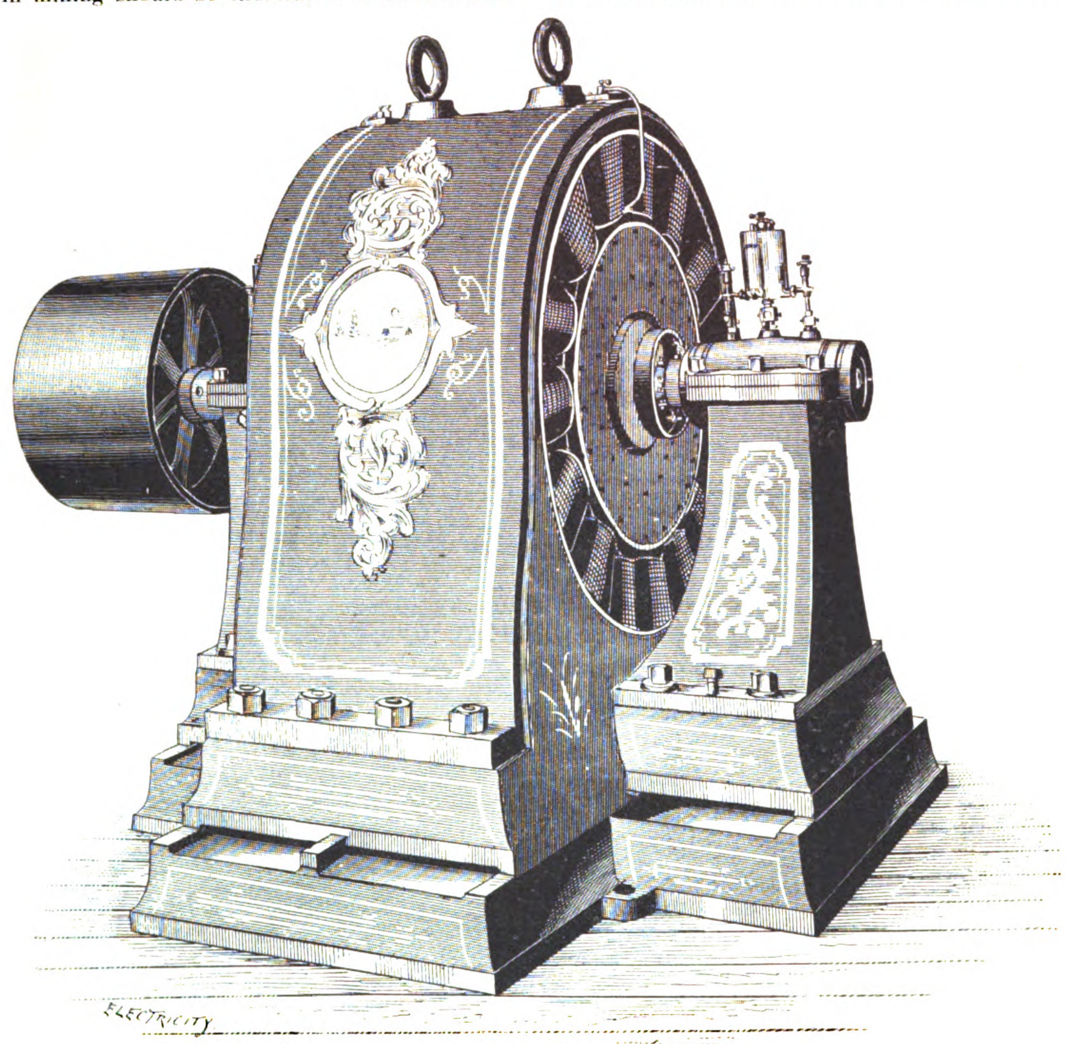
NEW NATIONAL ALTERNATOR.

The new 2000 light alternator constructed by the National Electric Manufacturing company of Eau Claire, Wis., is shown in the accompanying cut. While not differing much from the standard type, it has several improvements in its details.

The field magnet frame is of somewhat novel construction, being cast in one piece, and not split, as is the usual practice. The magnetic circuit is consequently absolutely unbroken, while from a mechanical standpoint, the manufacture seems to be simplfied. The machine has 14 poles, and when driven at a speed of 975 revolutions develops an e. m. f. of 1000 volts. The armature conductors are sufficiently large to carry a current of 120 amperes without undue heating. The machine is separately excited, requiring 125 volts in its field, absorbing 15 amperes, or a total energy of less than 1900 watts.

Another novel feature consists in the disposition of the collector rings, which are not placed side by side on one end of the shaft, but are arranged one at each end of the armature, making it absolutely impossible for an attendant to touch both brushes or collector rings at the same time.

The journal supports, or standards, are cast hollow, forming a receptacle for waste oil from the journals. The dynamo proper is placed upon a sub-base on which the machine may be moved by means of a screw and hand wheel, not shown in the cut, to provide proper tension for the belt.



NATIONAL TWO THOUSAND LIGHT ALTERNATOR.

ELECTRICAL ELEVATOR INDICATOR.

The rapidly increasing value of real estate in all large cities and the desire to concentrate business into as small a space as possible, have led architects and capitalists to construct the modern building with many stories towering above the little structures of the last decade. With the advent of high buildings comes the necessity of providing means for reaching the upper floors safely and quickly. If the art of building has progressed marvelously, how much more marvelous have been the improvements in the elevators

FIG. 1—ELECTRICAL ELEVATOR INDICATOR.

from the old-fashioned buckets which jerked the passenger into upper stories and possibly into eternity at the same time. The American inventive faculty has conquered all the little troubles and has thrown such safe-guards around the elevators that now-a-days it is indeed a rare thing to hear of an accident on an elevator except at the result of gross carelessness on the part of the victim.

The most important improvements in elevators consist in methods of signalling in order that the conductor may know where the passengers are in need of his services, and that the passenger may ascertain where the car is and which way it is traveling. By these signals the time of taking on passengers may be reduced to

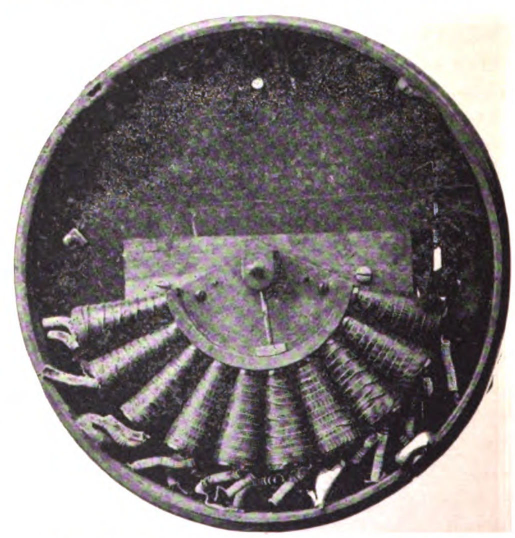


FIG. 2—ELECTRICAL ELEVATOR INDICATOR.

the minimum and one may know which car to signal.

These results have been effected heretofore almost entirely by mechanical means, but a device has lately been introduced which accomplishes the same purpose by electrical means. As the electrical system possesses great flexibility, it is far better. The apparatus has been in use in the Auditorium Building for some months and has given perfectly satisfactory results.

Fig. 1 represents the indicator, which consists of a circular metal box with figures cast on it denot-

ing the several floors in the building. Attached to the shaft in the center of the indicator is a needle which points to the figures. Fig. 2 shows the indicator with the cover removed, exposing the mechanism, which consists of a magnet for each floor. A swinging armature which is attached to the shaft and which carries the needle, is drawn successively by the current in front of each magnet. The magnets which correspond with each floor are joined in series.

What may be called indication lines run to a convenient point near the cylinder of the elevator

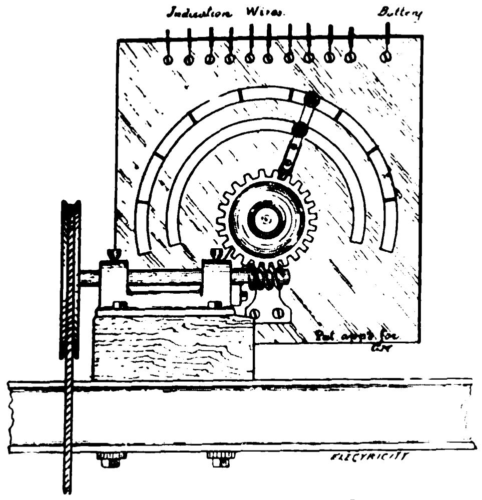


Fig. 3—Electrical Elevator Indicator.

where they connect with the commutator, as shown in Fig. 3. The brush of the commutator is actuated by a screw and gear wheel, so proportioned that in each trip of the elevator a brush passes through each segment of the armature successively, throwing the current on each series of magnets, and drawing the swinging armatures of the ten floors, each in front of the magnet corresponding with that series. It will readily be seen that the cars can make the trips as rapidly or as slowly as may be desired and can go to any point in the shaft and descend, and needles will still follow the movements of the car, indicating at all times its exact position. An indicator, too, may be placed in the office of the engineer, in order that he may know at all times the position of the cars. The device was invented by Chas. G. Armstrong, Chicago.

ELECTRICAL CURRENT TOPICS.

The new University of Chicago will include in its departments a school of electrical engineering. A school of arts will be organized, in which the electrical section will be a prominent feature. When President W. R. Harper was questioned about the school a few days ago he said: "The school of practical arts has been planned by one of the best men in the country. If we had the money this department could be opened in 1892, but we have no fund to use for that purpose. Our money is tied up; that is, it is devoted to other purposes. Now we would like $500,000 to endow this school of practical arts. It may soon be forthcoming for aught we know." Here is a chance for some one with a half million at his disposal. The new university needs a benefactor who will do for it what Hiram Sibley did for Cornell.

* * *

No paper for months has excited in electrical circles such wide spread interest as that of Nikola Tesla, read before the American Institute of Electrical Engineers. His experiments with alternate currents are wonderfully interesting and suggestive. All attempts at securing light without heat must excite general interest, even though the investigation, as in parts of Mr. Tesla's work, is in the most occult domain of electrical theory. The daily papers have indeed taken the subject up; and ere long Mr. Tesla will find, if he follows their comments, that he has made even more remarkable discoveries than he supposed.

The next convention of the Electric Light Association will be a novel one. The members will meet in the interesting city of Montreal. Those who intend to be present at the meeting should polish up their French, as one hears more French in the streets of Montreal than English. They will thoroughly enjoy their stay, for the Canadians are determined to give the delegates a rousing reception. A. J. Corriveau, the local member of the executive committee, is enthusiastic and is working day and night to make the convention successful. In a recent letter to the editor of Electricity he says of the electrical exhibit: "My impression is that this electrical exhibition will surpass anything of the kind yet attempted."

* * *

Two well-known correspondents are now away from their ordinary haunts, and are sending letters as they journey along. Frank G. Carpenter is in Mexico. He has just been talking with President Diaz. The latter says that Mexican mines offer a splendid field for investment. One is impressed in reading the interview with the fact that Mexico will soon be a splendid field for the sale of American electrical machinery apparatus for the transmission of power, and general electrical machinery for mines will doubtless be demanded on a considerable scale within a comparatively short time.

* * *

Walter Wellman is writing from Nassau, Bahama Islands. He speaks at length of the lazy, non-progressive spirit of the place, and his remarks show that the country which he is visiting is as unfavorable a field for the electrical manufacturer as Mexico is promising. He says of Nassau:

"There isn't an electric light nor a street car nor a steam engine nor a typewriter nor a mail carrier nor a telephone nor a telegraph wire nor any of those disturbing inventions of civilization in the island, and they don't want any of them."

* * *

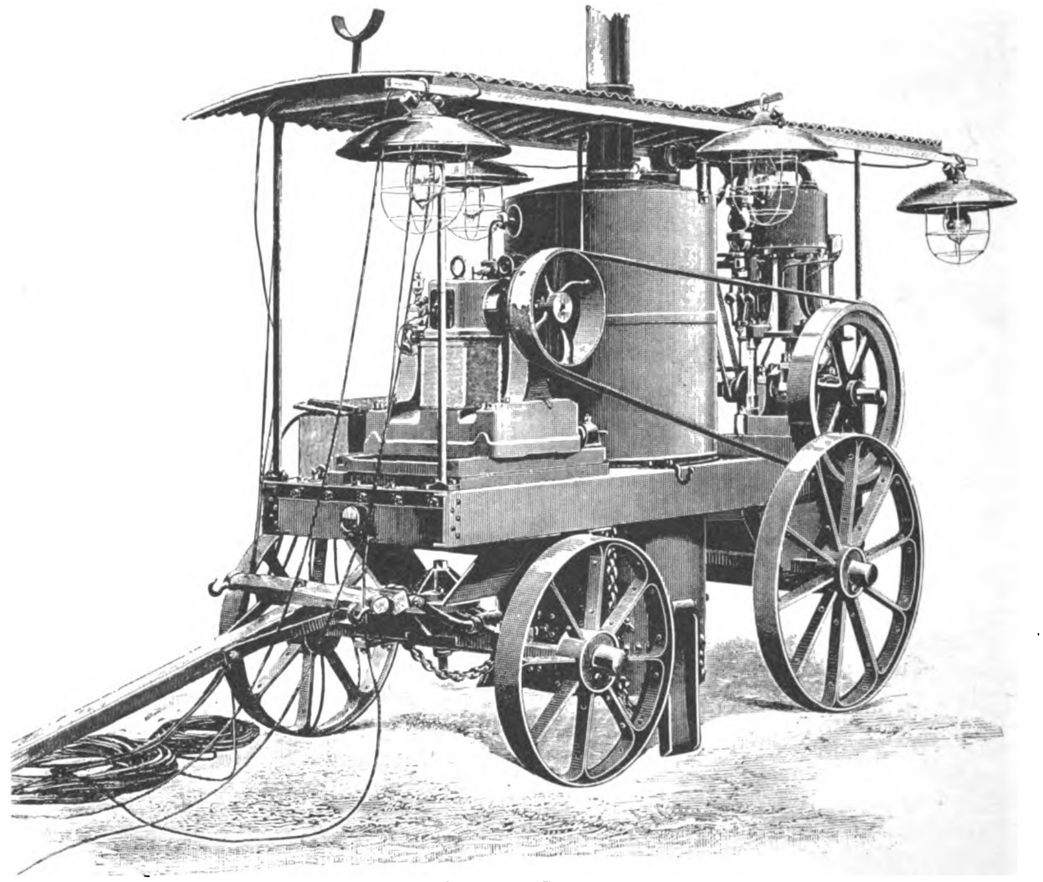
"I look for a good business in August" said a supply man a few days ago. "It is dull now, but there are a great many persons who have purchases to make and will soon make them. When the crops are moved money will be easier in the West. Tightness of the money market is my explanation of the fact that the business is not brisk just now."

ELECTRIC LIGHT FOR WHEELING.

Members of the Wheeling, W. Va., Electric Light Commission, members of the City Council, and members of the Board of Trustees were in Chicago a few days ago. The city of Wheeling will be lighted by electricity on a very extended scale. Bids have already been received, but before a decision was made representatives of the several bodies particularly interested in the new system of illumination determined to visit the large cities, inspect their electric light plants and see the factories in which electrical machinery is made. When the party reached Chicago it had traveled about 4,000 miles, and it will cover a greater distance before it reaches home. Before coming to Chicago the travelers had visited Pittsburg, Buffalo, Cleveland, Toledo and Ft. Wayne. From Chicago they went to St. Louis, and thence to Detroit. On Wednesday last they left for the East.

PORTABLE ELECTRIC LIGHT PLANT.

A portable electric light plant is oftentimes extremely useful for many kinds of outdoor work. The combination shown in the illustration was designed by Hayward, Tyler & Co., of London, for use at a dock. The plant is mounted upon a frame carried by four wrought-iron traveling wheels. The boiler stands in the center, the engine being at one end and the dynamo at the other. The boiler is 6 ft. 6 in. high, by 2 ft. 9 in. in diameter; the firebox is crossed by two tubes 8 in. in diameter. The engine has a cylinder 5 in. in diameter by 6 in. stroke, and is of the inverted type with Pickering governor. By means of a belt it drives the dynamo. This is compound wound to give 20 amperes of current at a pressure of 10 volts, when running at 650 revolutions per minute. The dynamo was designed to run four incandescent lamps of 200 candle-power each. Each lamp is provided with a strong enameled iron reflector fitted with a wire guard, and a length of twin flexible cable. The cut is reproduced from *Engineering*, London.



Portable Electric Light Plant.

We don't see how but *Life* tells us that "when Edison's kinetograph comes into general use, we shall at last be able to see what that sweet-voiced operator at the Central office really looks like."

ELECTRIC RAILWAY SYSTEM OF CINCINNATI.

BY NELSON W. PERRY.

Part I.

The electric street railway system of Cincinnati has probably attracted more attention in certain circles than that of any other city, and perhaps than that of all other cities in the country. This is true partly because of the great extension of the double trolley system there, which exceeds that in all other cities combined, and second because of the at first successful litigation instituted by the telephone interests against the single trolley system.

A brief reference to the latter may serve as a fitting introduction to the subject of this article.

The Sprague single trolley system was the first introduced into Cincinnati and was employed by the Cincinnati Inclined Plane Railway Company, usually known as the Mt. Auburn line. The operation of the cars created considerable trouble in the telephone service, and the Cincinnati & Suburban Telegraph Association (the local Bell Telephone Company) sought to enjoin the Mt. Auburn Street Railroad Company from using the single trolley.

The trial came on before Judge, now Solicitor General, Wm. H. Taft, in the Superior Court and the fight was a most bitter one. Both sides agreed to make this a crucial test of the principles involved, and not only were they both represented by the most eminent legal talent, but each called to the stand the most celebrated electrical experts in the country.

In the meantime the Colerain Avenue double trolley road (Thomson-Houston) of about equal length had been put into operation and it seemed as though the local interests were about equally matched.

But the interests were by no means local, but involved those of every electric railway and every telephone company in the country either then in operation or prospective.

With such interests at stake, counsel on both sides exerted every effort to evolve some point favorable to their clients until the testimony piled up to make a volume, when bound, over eighteen inches thick, and the learned judge who presided and the attorneys on both sides became, before the end of the trials, electrical experts of high attainment, and the audience who listened to the proceedings talked as glibly about dynamic and static induction, ohms, volts, amperes and watts as the veriest patriarch in electrical science.

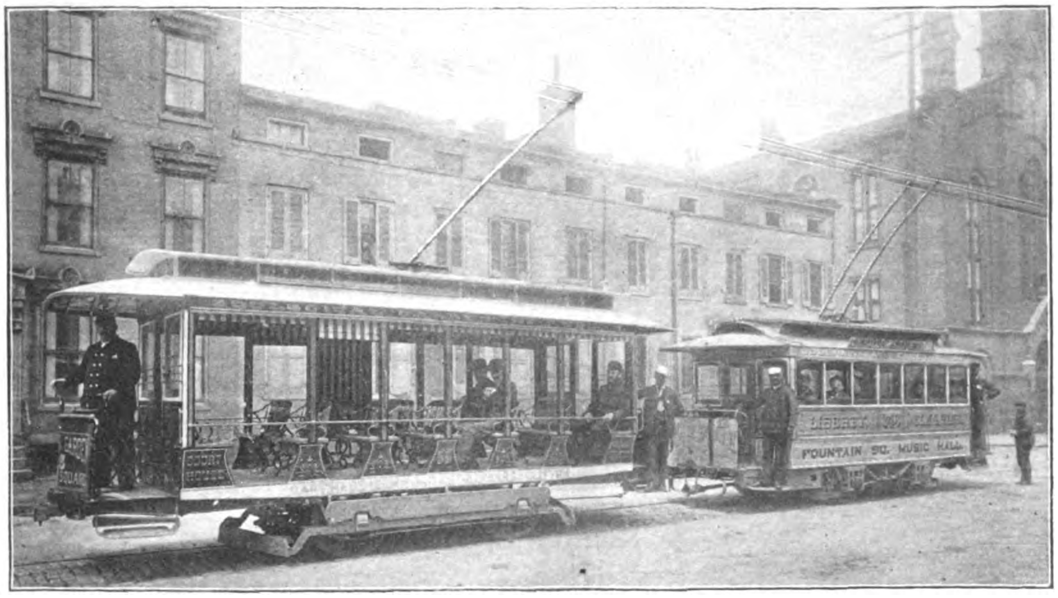
The decision of Judge Taft, couched in terms that would do credit to the most thorough electrician and at the same time with the clearness and simplicity for which he is so noted, was *against* the single trolley.

Though many suits involving the same principles had already been tried in various parts of the country, this was the first to be decided in favor of the telephone interests, and therefore attracted wide attention.

To this decision the railroad company demurred, and on appeal took it up to the general term of the Superior Court where the former decision was sustained, Judge Hunt dissenting.

The next step was to the Supreme Court where the decisions of the lower courts were reversed, and the single trolley was at last triumphant.

This brief resume will probably be considered to present sufficient reasons to account for the many miles of double trolley road now in operation or in construction in and around Cincinnati, and it will be interesting to note the character of the roads that will follow in view of the settling of the legal status of the single trolley system in its conflict with the telephone interests. The near future will also very clearly settle the mooted question as to the relative merits of the two systems, for they have both been well tried in Cincinnati, and both proved eminently satisfactory not only to their owners but also to the public generally.



Electric Railway System of Cincinnati—Double and Single Trolley Cars on Same Track.

Many interesting points were brought out in the testimony and doubtless both the electric railroads and the telephone interests were ultimately benefited by the publicity given to them.

One of the most interesting points brought out was the relative costs of operating the two systems.

Mr. H. M. Littell, manager of the Mt. Auburn (single trolley) line swore that the expense of operating his line for power alone was $6.18 per car per day while Mr. John Kilgour, Pres't of the Cincinnati Consolidated Street Railroad Company operating the Colerain Avenue (double trolley) line stated under oath that it cost them but $4.30 per car per day—the mileage being about the same.

The running expenses on the two lines were hardly comparable, however, since on the Mt. Auburn line there are many curves and high grades, one of the latter reaching 13.2 per cent. while on the Colerain Avenue line, as then completed, there were practically no curves and the grades were easy.

With the extension of the Colerain Avenue route to the center of the city a difficulty arose which had not occurred elsewhere. For a distance of nearly half a mile the Colerain cars must run over the same track as the Mt. Auburn line and this distance had already been preempted by the single trolley wire. The same track had therefore to be wired for both single and double trolley cars. This was accomplished by placing the double trolley wires on either side of the single trolley wire—all three being supported by the same span wires.

Since the double trolley wires of this road are 18 inches apart, they are each 9 inches from the central wire. But to complicate matters, at one curve the single trolley wire had to cross the negative of the double trolley to get its central position, and at another curve recross it to get out again.

Since the single trolley was first on the ground, this had to be accomplished by the Colerain people in such a way as not to cause interference. A crossing of trolley wires is at best an awkward contrivance—it is especially so when it occurs on a curve. One of these crossings, too, occurs at 5th and Walnut streets where the Mt. Auburn line turns to the east and the Colerain Avenue line turns to the west, which of course added to both the electrical and mechanical difficulties.

Since the two roads are operated by entirely distinct companies, no concessions were expected from the Mt. Auburn people, hence had the problem not been solved entirely satisfactorily to the latter there would have been war in camp. That such war has not occurred is ample proof of the success of the plan adopted.

As a matter of fact, cars on both lines make their curves apparently as smoothly as though the other line was not in the neighborhood.

Immediately after leaving the single trolley line at 5th and Walnut streets, the Colerain Avenue line comes on another single track which is occupied jointly with them for a block by the South Covington and Cincinnati street railway, another double trolley road (Short system.) Here again the two roads are operated by separate companies, and for this reason they could not occupy the same wires. For 400 feet, therefore, there are four wires strung over a single track—two being used by one road and two by the other.

In this connection two very interesting questions arose which I have undertaken to answer.

1st. In case a double trolley car should place one trolley on the single trolley wire and the other upon its own negative, would it receive current, and if so under what circumstances and from which dynamo?

2nd. If a double trolley car should occupy the positive wire of one double trolley road and the negative of another would it receive current, and if so, under what circumstances and from which dynamo?

It will be apparent from the above description that the Colerain avenue cars have an opportunity of trying both of these experiments.

It would seem at first that the answers to both of the above questions would be "no," and so it would if perfect insulation were maintained, a condition that is never attained.

As a matter of fact the Colerain avenue cars *do* run under both of these conditions, therefore I have found the answers to the questions more interesting and complex than I had expected them to be.

I was called upon to state the conditions fully and I append them below, with illustrative diagrams.

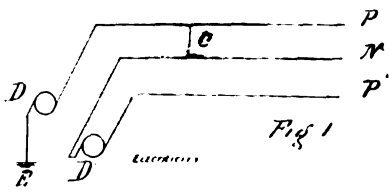
In Figs. 1 to 6, D represents the dynamo of a single trolley road and P the wire, while D' represents the dynamo of a double trolley road; N' and P' the negative and positive wires.

In Fig. 1, C represents a double trolley car with one trolley on the wire P of the single trolley road, which is always positive, and the other on N the negative wire of the double trolley road.

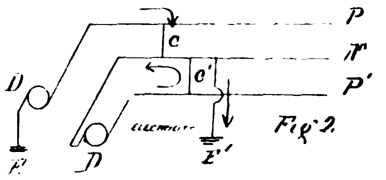
In this case there are no leaks or grounds on the double trolley road and although C embraces both a positive and a negative wire, it can receive no current because they belong to different dynamos and no circuit is closed thereby.

In Fig. 2, there is a ground on the negative. Under these circumstances C' which is running

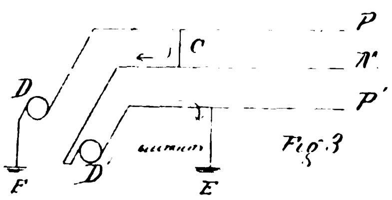
on both of its own wires will receive current solely from its own dynamo D' and C will receive current solely from D.



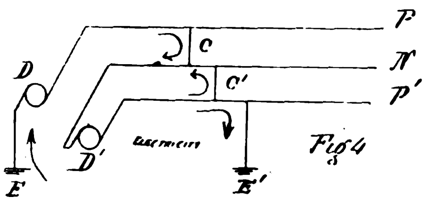
In case there were no car C', C would still receive current alone from D, and notwithstanding the ground, D' would generate no electricity since its circuit is not complete (See Fig. 6). The circuit of D is however complete through P, car C, ground E' to E.



If however the ground were on P' instead of on N (Fig. 3) then C would receive current from both dynamos and in case there were no cars on the single trolley road, C would receive current at 1000 volts instead of at 500 as the two dynamos are now in series. The current would follow the course indicated by the arrows.

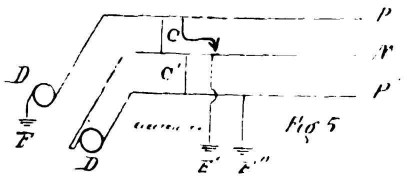


If the ground were on P' and there were a car C' (Fig. 4), both cars would receive current, each dynamo contributing its share. Also if either dynamo should stop they would still receive current from the other. That is to say, if either dynamo be stopped, the other will furnish current to both cars, and the idle dynamo will be driven as a



motor. If D' be idle, C' and D' will be in multiple with each other and in series with C and receive current at 250 volts. If D be idle, D and C will be in series with each other and in multiple with C'.

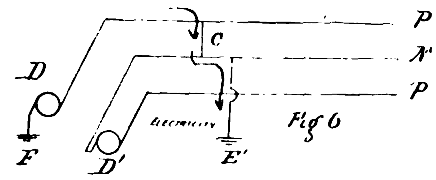
In case both sides of D' be grounded (Fig. 5) both cars would receive current at the same pressure. If the two positives P and P' be connected



by leakage or otherwise, we have the same state of affairs as though P' were grounded and there were a car on the single trolley road—viz. P grounded also. If both P and P' are grounded and the negative wire N of the double trolley road is neither grounded nor in any way electrically connected with its positive wire, then car C can receive no current.

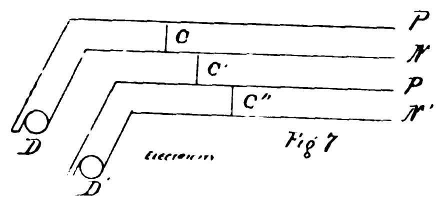
TWO DOUBLE TROLLEY ROADS.

Fig. 7 represents a car C' occupying the positive P of one road and the negative N of another these two roads being occupied respectively by cars C and C'. In this case there being no grounds on either road, C' can receive no current, although all four wires are electrically connected by means of the three cars. This is so because neither dynamo can receive more or less current than it gives out, and were C' to receive current one dynamo *would* receive *more* and the other less than it generated.



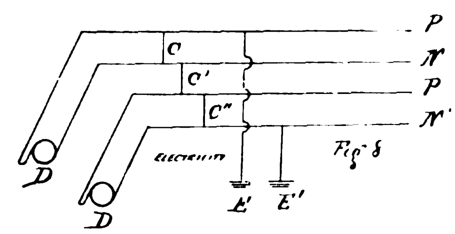
If however there be a ground on both the positive P of one road and the negative N of the other (Fig. 8) C' could run as well between the two roads as though it were on either of them, and would receive current from from dynamo D.

The grounding of a single wire of either circuit



would not however, enable C' to get current, nor would the grounding of both positives or both negatives, or two or more grounds on the same wire help matters.

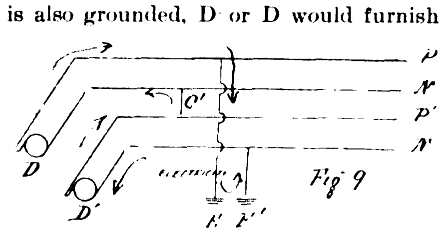
In (Fig. 8) both roads are represented as being occupied by cars CC'. If as in (Fig. 9) they be not so occupied but the grounds remain the same,



both dynamos will contribute to C', and being in series will deliver current at 1000 volts instead of at 500.

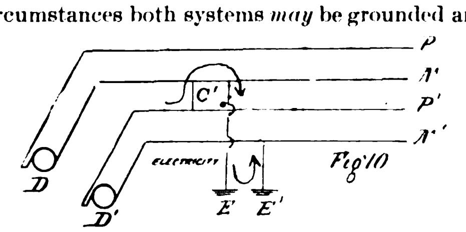
If the grounds are arranged as indicated in Fig. 10, D' alone will furnish current to C'.

If both N and P' are grounded and either P or N' is also grounded, D' or D would furnish the



current and if all four wires are grounded *both* dynamos would contribute electricity to C'.

Thus we see that a car C' occupying the positive wire of one system and the negative of another, can never receive current unless *both* systems are grounded. We also see how under some circumstances both systems *may* be grounded and



yet contribute no current to C' and how under others either or both dynamos will furnish current to C' under 500 volts pressure and under still others how the two dynamos may be thrown into series and contribute current at 1000 volts; - this whether one system be single trolley or both be double trolley.

(*To be continued.*)

A WORLD'S FAIR SUGGESTION.

BY C. O.

The managers of the World's Fair are constantly receiving suggestions to enhance the attractiveness of the great Exposition of 1893. One idea has just been proposed which, while perhaps rather startling, is still believed to be entirely practicable, and worthy of investigation. At first the project may seem flighty, and even impossible of accomplishment; but upon a more serious consideration, we think that it could be developed to such an extent that it would not only form one of the most novel and entertaining features of the Columbian Exposition, but would illustrate in a striking way the marvelous progress that the electrical industries have made in the last few years in this country.

The suggestion, bared of any technical details, is to establish a generating station of enormous capacity at Niagara Falls and transmit the current to supply power and light for electrical apparatus utilized in the display. At first there would be seemingly unsurmountable difficulties but with the advice and assistance of some of our foremost electrical and mechanical engineers they could be readily overcome. With the remarkable development of the alternating current system for the transmission of power over long distances, and with the superior grade of insulation that is now readily secured, there seems to be no reason why a current of 50,000 volts could not be transmitted from Niagara Falls to Chicago. Surely we are not wholly without precedent in this matter, as the experiments carried on by Mr. Brown in Oerlikon can be cited, where a pressure of 33,000 volts was maintained over a considerable distance during a severe thunder storm. Extensive preparations are now making to transmit power from Lauffen to Frankfort-on-the-Main, a distance of over 100 miles.

With the push and energy of our electrical engineers can we not "go our German brethren one better," and construct a line from Chicago to Niagara, a distance of a little less than 500 miles? We certainly have the season of the year in our favor. The Exposition taking place as it does in the summer months, when the atmosphere is extremely dry—something of which Germany cannot boast—the line construction would cost less per mile and there would therefore be a considerable decrease in the total cost of construction.

Of course the first objection that would be raised against such an undertaking would be the great expense of building and operating the required line; but we think that this could be easily met by a combination of interests, whereby the Exposition managers, the electrical industries and a development company might be induced to bear a certain proportion of the expense. To say that the scheme would be novel "would be putting it very mildly." The foreigner on his way to the Exposition would naturally take a look at the Falls, and on being told that the water that he saw pouring over the precipice was producing light, heat and power at a distance of 500 miles, would not only be astonished at our great achievements, but his attention would be immediately directed toward the Electrical Department of the World's Columbian Exposition.

THE Berlin Electricity Works, which have now been in operation for several years, supply current to a larger number of incandescent lamps than any other company in Europe. There are at present four central stations in regular service, and in a few months the number of lamps connected with the mains will be 185,000, or as many as the whole of the lights furnished by the London electric light companies and private installations put together. In 1885 the Berlin company had twenty-eight customers, while on the 1st of June this number had increased to 1310.

STAR TROLLEY WIRE CLAMP.

The cuts show a new trolley clamp, for which strength and simplicity are particularly claimed. The clamp consists of but three parts, the two

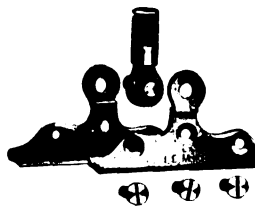


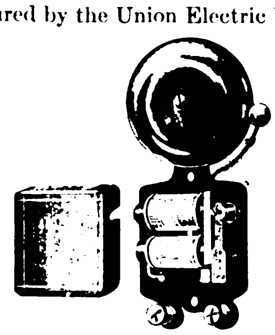
Fig. 1.

Fig. 2. Star Trolley Wire Clamp.

lips and the swivel pin, as shown in Fig. 1. Three screws put the clamp together. The clamp is used with the ordinary rubber bell, as shown in Fig. 2. The device is made by the Illinois Electric Material Company, Chicago.

IRON BOX BELL.

The cut illustrates an iron box bell that is manufactured by the Union Electric Works, Chi-



Iron Box Bell.

cago. The bell is of the ordinary double magnet style and is neat in appearance. It has an extra heavy platinum contact, and, as will be noticed, a slot is left in one side of the cover, making it possible to adjust the hammer.

NEW SNAP SWITCH.

In the accompanying cuts is illustrated a new style of snap switch, designed for the purpose of opening a circuit on sudden notice, and with very little exertion on the part of the person in charge. The operation of the switch is extremely simple and its usefulness is obvious. Fig. 1 shows the switch closed and the handle lying flat. Should it be necessary to open the circuit suddenly the attendant brings the handle to a vertical position, as indicated in Fig. 2, and a spring located in the center of the blade breaks the circuit. The switch is introduced by the Electrical Supply Company, Chicago.

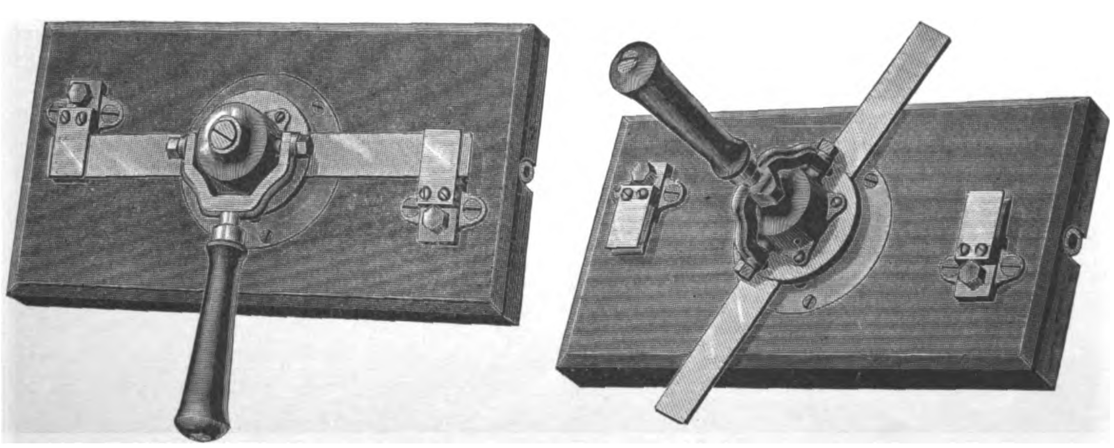


Fig. 1. New Snap Switch. Fig. 2.

EDISON COMPANY VICTORIOUS IN THE INCANDESCENT LAMP CASE.

Judge Wallace, in the United States Circuit Court, New York, last week, handed down a decision in the great case of the Edison Electric Light Company against the United States Electric Lighting Company, for alleged infringement of the incandescent lamp patent. The decision was a substantial victory for the Edison interests. As the case has been so thoroughly followed by the daily press, a mere summary of the decision is given here. The real controversy was over Clauses 1 and 2 in Patent 223,898. "The plaintiff contends," says Judge Wallace, "that these claims are for fundamental inventions of great merit, and are entitled to a construction by which every incandescent lamp for electric lighting, consisting essentially of a filamentary carbon burner, hermetically sealed in a glass vacuum chamber, is within their terms. The defendant contends that unless the claims are limited to narrow inventions, not employed by the defendant, they are invalid for want of patentable novelty."

The court discusses at considerable length the prior state of the art, and quotes the claims, the first and second of which are as follows:

"1. An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires as set forth.

"2. The combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted, for the purpose set forth.

"The specification is addressed," says Judge Wallace, "to those skilled in the art, and he summarizes it and the claims as follows:

Read by those having this knowledge the radically new discovery disclosed by the specification is that a carbon filament as attenuated before carbonization as a linen or cotton thread, or a wire seven one-thousandths of an inch in diameter, and still more attenuated after carbonization, can be made which will have extremely high resistance and be absolutely staple when maintained in a practically perfect vacuum. It informs them of everything necessary to utilize this discovery and incorporate it into a practical lamp. It describes, with the assistance of the recital in the second claim, as the vacuum in which the burner is to be maintained, a bulb made wholly of glass, exhausted of air, sealed at all points by the fusion of the glass, and in which platinum leading wires are sealed by the fusion of the glass. It describes the materials of which the burner is to be made and instructs them that the materials are to be shaped into their ultimate form before carbonization. It describes the use of platinum for the leading wires, and a method of securing the leading wires and filaments, intended to dispense with clamping, which consists in molding tar and putty about the joints, and carbonizing the whole in a closed chamber. Besides stating that the resistance of the burner will be greatly increased and the radiating surface still be kept within moderate limits by coiling it in the form of a spiral, the specification states that by increasing the length of the filament coiled, the exterior only will be the principal radiating surface, and greater steadiness of illumination will be promoted.

The defendant does not infringe the first claim "if for no other reason, because the leading wires in its lamps are not secured to the filament according to the method of the patent; that is, by cement carbonized in situ, by clamps such as the specification condemns."

The decision continues as follows:

It was a remarkable discovery that an attenuated thread of carbon would possess all the long-sought qualities of a practical burner when maintained in a perfect vacuum. The extreme fragility of such a structure was calculated to discourage experimentation with it, and it does not detract in the least from the originality of the conception that previous patents had suggested that thin plates, or pencils, or small bridges, could be used. The futility of hoping to maintain a burner in vacuo with any permanency had discouraged prior inventors, and Mr. Edison is entitled to the credit of obviating the mechanical difficulties which disenheartened them, but what he did in this respect was a matter of only secondary merit and was no longer new in the art, because he had already disclosed it in his French and English patents. What he actually accomplished was to unite the characteristics of high resistance, small radiating surface, and durability in a carbon conductor by making it in a form of extreme tenuity, out of any such materials as are mentioned in the specification, carbonizing it, and arranging it, as he had previously arranged his platinum burner in an exhausted bulb made wholly of glass and sealed at all points, including those where the leading wires entered, by the fusion of the glass. He was the first to make a carbon of materials and by a process which was especially designed to impart high specific resistance to it; the first to make a carbon in the special form for the special purpose of imparting to it high total resistance; and the first to combine such a burner with the necessary adjuncts of lamp construction, to prevent its disintegration and give it sufficiently long life. By doing these things he made a lamp which was practically operative and successful, the embryo of the best lamps now in commercial use, and but for which the subdivision of the electric light by incandescence would still be nothing but the *ignis fatuus*, which it was proclaimed to be in 1879 by some of the learned experts who are now witnesses to belittle his achievement and to show that it did not rise to the dignity of an invention.

Several other questions are considered by Judge Wallace, but no point is mentioned which has any bearing on his decision. He merely mentions them to dismiss them. He speaks, for instance, of the coiled form of filament and says it is not an essential part of the Edison patent. Improvements have been made in the lamp but "the invention of the slender thread or carbon as a substitute for the burners previously employed opened the path to the practical subdivision of the electric light."

The decree for an injunction and accounting is ordered.

UNIVERSAL TELEGRAPH SYSTEM.

When the yacht of Mr. Pulitzer, of the New York *World*, was in Nice recently, a correspondent interviewed the sailing master, who is somewhat fond of hyperbole. He said the cruise was undertaken by the owner of the vessel for both pleasure and discovery. This led the correspondent to ask:

"What did they want to discover?"

"They were trying to find a place where there is no telegraph office."

"Did they find it?"

"No, there is no such place. There is not a spot anywhere in the world that has not got telegraph wires running to all the other places, and especially to New York."

"Some of the little islands are without such a convenience, I should imagine?"

"There you are wrong. Why, one blustering night we ran into a port on a little barren island on the Albanian coast—a mere heap of stones, you might call it—and there was the telegraph office and a cable to the mainland. Another night we ran into a snug corner—utterly away from the world on the west coast of Greece. Nobody ever lived there but an ancient Greek named Nestor. His house was tumbled down a thousand years ago; but there was the telegraph office up a rickety pair of stairs in the main street. It's so everywhere."

The National Electric Manufacturing Company has received an order for five of its 2,000 light alternating current machines from the Citizens' Electric Company of St. Louis.

FROM NEWS CENTERS.

NEW YORK CITY.

NEW YORK, July 18. The main subject of conversation among the electricians of New York is Judge Wallace's finding in the Edison incandescent lamp suit against the United States Electric Lighting Company. The other electric companies profess not to be greatly disturbed by Judge Wallace's decision in favor of the Edison interests. Both the Thomson-Houston company and the Westinghouse companies claim that the decision will not seriously affect them. The patent has only two or three years more to run, they say, and is sustained only in part by the decision. No incandescent lamps have been manufactured at the Westinghouse factories in Pittsburgh and Newark for over two years, and the Thomson-Houston company has been purposely narrowing down its lamp business for some time. An appeal from the decision will be taken at once and will come before the new Appellate Court for patent cases, probably in October.

Warden Brown, of Sing Sing Prison, has forwarded to County Clerk Giegerich the official report of the execution of the death sentence upon Smiler, Wood, Slocum and Jugiro, on July 7. Attached to the report was a letter from Dr. C. F. Macdonald and Dr. S. D. Ward, congratulating the warden on the completeness in every detail of the preliminary arrangements, upon the decorum which prevailed during the execution, and on "the resulting demonstration of the rapidity and painlessness of this method of inflicting the death penalty. The experience has proved to our satisfaction, that this method is superior to any other yet devised." The letter further states that all the condemned men walked firmly and without assistance, seated themselves in turn in the electric chair and without the slightest protest or resistance, submitted to the adjustment of the retaining straps and electrodes. It is also stated that in each case "unconsciousness was produced instantaneously by the closing of the circuit. This unconsciousness was absolute, and persisted without interruption until the heart's action had entirely ceased and death had certainly occurred. In each case death was manifestly painless."

The popular feeling in New York is strongly against electrical executions. In a lecture on the subject at Union Square Hall Lane O'Neill condemned the statutory secrecy at such executions in a very uncompromising way. He said that the statutory provisions were antagonistic to the spirit and the letter of both the national and the state constitutions. In his opinion the people were the ultimate judges of the new method of capital punishment, and they should know all the facts. Mr. O'Neill gave a graphic description of the horrors that might be hidden beneath the shroud of secrecy, and stigmatized the law as a scandal in legislation. This sentiment is echoed with even greater force by many of the daily papers.

Mayor Grant has been placed in an invidious position by the opinion of Corporation Counsel Clark, which was presented at the last meeting of the Board of Electrical Control, on the question of the power of the board to revoke the contract and declare forfeited the bond of the Consolidated Subway Company. It will be remembered that this forfeiture was actually pronounced at a recent meeting of the Board, and it created some little consternation in the minds of those who were inclined to regard the procedure as legal. It now appears that the mayor was somewhat premature. The corporation counsel declared that the Board had no authority to take the action in question, and that the resolution to take that course which was adopted by the Board was inoperative. He cited several precedents in which the courts had decided that such contracts could not be declared void nor the bonds on such contract be forfeited, except after judicial determination. Mr. Lauterbach, the representative of the Subway Company, said, in his usual bland and tactful way, that he knew all along that the decision would be favorable to the company, and that it was ready to proceed promptly with the work that had been interrupted by the passage of the resolution. The length of wire removed by direction of the Board of Electrical Control from January 1 to July 1 is 5,573 miles. G. H. G.

BOSTON.

BOSTON, July 18.—A summary of statistics, which is about the first authentic statement obtained officially from the West End Street Railway Company and, which may, therefore, be relied upon, shows the comparative expenses of operation as between horses and electricity, during the months of April and May. In comparing the following figures it must be remembered that only a part of the West End system is as yet electrically equipped. The company has to purchase its power for operating certain sections from various electric companies, as it has not yet had time to complete its own power stations, besides having to labor under other disadvantages incidental to making so radical a change from horses to electric motors.

The statement is as follows:

	Total.	Electric.	Horse.
Gross receipts, April	$478,717	$134,321	$344,396
" " May	519,244	144,638	374,605
Total operating expenses, April	362,781	85,834	276,947
" " " May	353,720	84,163	269,556
Net earnings, April	115,935	48,487	67,449
" " May	165,524	60,475	105,049
Per cent. operating expenses, April	76.82	63.36	80.62
Per cent. operating expenses, May	68.12	58.18	71.95
Total expenses per mile run, April	24.54	21.75	25.55
Total expenses per mile run, May	24.04	22.36	24.62
Net earned per mile run, April	07.85	12.30	06.22
" " " " May	11.25	16.07	09.60

The new style of cars recently introduced, which are longer and carry more passengers than the ordinary ones, show even better results than the foregoing. The long cars earned $83,000, or 44 cents per mile operated in May, and 46.9 cents per mile in the first half of June, the latest period for which figures are obtainable. The net earnings of the company gained over those of last year were $15,000 in May, and are likely to show an increase of $30,000 net for June.

Among local companies which have recently declared dividends are the Brookline Gas Co., which owns an extensive electric lighting plant, $3.50 per share; Salem Electric Lighting Co. quarterly dividend of 1½ per cent; American Bell Telephone Co. on preferred stock $3 per share, also an extra of $6 per share.

Electrical men in and around Boston were a good deal interested and more than a little surprised when they read a paragraph in a rural newspaper, whose editor or reporter is apparently quite fresh and verdant, a few days ago, that "Boston and Portland will soon be connected by electric street roads—a continuous seventy miles, from village to village, being already constructed and in use."

Since the introduction of electrical apparatus the use of mica as an insulating medium has been steadily on the increase and New England has proved to be by far the largest producer as well as consumer of this valuable substance. The estimate of consumption for the present year, almost entirely for electrical purposes, is placed at $200,000, and of this amount New Hampshire will supply $160,000 worth. Those engaged in the business are particularly busy, Boston being the principal market for it.

The Naumkeag Horse Railway Co., which has adopted the electric system on part of its track, is to make another effort to obtain permission to construct the overhead trolley system right into Marblehead. The people, as a whole, realizing its advantages, are strongly in favor, but there are some croakers who are raising great opposition, to the annoyance of the company and the inconvenience of the public.

The Shawhan Electrical Works Co. has been incorporated at Concord, N. H., with a capital of $50,000, and the directors will at once make preparations for starting their business, thus adding another industry to the flourishing city of Concord.

The promoters of the newly incorporated electric freight railway company at Quincy, Mass., are encountering much opposition. As is well known there is an enormous traffic in freighting granite from the quarries to the ship wharf at Quincy Point, to the Old Colony Railroad at Quincy, Adams, and to Boston. In consequence the streets are in a fearfully dilapidated condition all the year round. The adoption of an electric freight railway as proposed will obviate that difficulty, and doubtless increase the granite business. But there are some opponents to the project. It is fortunate, however, that the directors are men of the highest character and experience; some of them old railway men, and bound to put the plan through whatever the opposition.

The New England Telephone and Telegraph Company being desirous of placing underground all its wires in the city of Worcester, Mass., petitioned the city council for the necessary authority. That august body, however, failed to grant the petition last Tuesday evening, and as the members are now taking a recess for the summer, matters must lie in *statu quo* until September 14 next. Meantime both the public and the telephone people have no alternative but to accept the situation.

Lawrence, Mass., is anxiously awaiting the completion of its new electric street railway system, which is expected to be ready in a few weeks from date.

The citizens of Portland, Conn., are warmly agitating the establishment of an electric light plant.

The Newmarket, N. H., Electric Light & Power Co. is a newly incorporated company which is to light the streets of Newmarket, and the stores, hotels and dwellings, as well.

On the evening of July 21st a town meeting is to be held at Spencer, Mass., to discuss the question of the selectmen purchasing both gas and electric light works, which are already in operation and achieving success financially.

Charles L. Bly, electrical engineer of this city, has recently equipped the steamer City of Haverhill, plying on the Merrimac river, with an incandescent lighting plant; also an 8,000 c. p. search light, placed on the pilot house. The Thomson-Houston system is used, and the novelty is fully appreciated by the large number of excursionists who patronize the steamer.

The first of August is the date fixed for opening the Leicester and Spencer, Mass., electric railway. The 400 h. p. engine, built by C. G. Cooper & Co., of Mt. Vernon, O., is now being put together, and every indication warrants the belief that the opening of the road will not be deferred.

Throughout electrical and financial circles in Boston a general feeling of satisfaction is expressed at the successful accomplishment of the Westinghouse Electric Company reorganization plan, which fact was announced in this morning's paper. The belief is that this successful move will give a speedy impetus to the electrical business generally throughout the country. All admit or concede that in the hands of such competent men as constitute the committee of reorganization and those who may be appointed directors, Westinghouse interests will not only be well cared for, but extended promptly and successfully.

That the recently-appointed Rapid Transit Commission for Boston is in dead earnest is indicated by the fact that two members of it, the Mayor and J. E. Fitzgerald, are to leave for Europe in a few days on a tour of inspection of street railways, to London, Paris, Berlin and other important cities. W. S. K.

OMAHA.

Omaha, July 17.—The electrical contractors of Omaha are complaining because the Thomson-Houston company will not make electric connections with motors other than its own.

The State Deaf and Dumb Institute in Omaha will be re-wired and many electrical improvements placed in the building this month. The school opens in September, and the work will be completed by that time.

John Burke, of Omaha, has been awarded the contract for placing a new electric system in the State Asylum for the Insane in Hastings; the work to be completed this month.

The Omaha Electric Railway Company has completed its new extension to East Omaha, a manufacturing suburb. The Thomson-Houston system is used.

The new buildings being erected in Omaha are supplied with electrical conveniences with scarcely an exception. Dozens of large flats have been built this spring and are supplied throughout with electric lights, call-bells, etc.

John Burke, for many years with the Midland Electric Company, has severed his connection with the firm, to engage in the business of an electrical contractor.

The Omaha and Council Bluffs Bridge Company, owning the electric car system of Council Bluffs and the line connecting the two cities, has perfected plans for building new lines in Council Bluffs. On most of the lines single motors are used, trains only running on Main street. The electric cars have given perfect satisfaction in Omaha and Council Bluffs, particularly the lines running over the hills.

The Omaha Street Car Company has decided to extend the electric car system to the suburbs and the additions lying four, five and six miles from the business section.

R. A. E.

INCORPORATIONS.

The Wisconsin Gas Company, Chicago, Ill.; capital stock, $2,000,000; to build and operate gas and electric plants; promoters, Wm. J. Lee, Truman M. Hall and Calvin C. March.

The Columbian Electrical Works, of Chicago, Chicago, Ill.; capital stock, $3,000,000; to manufacture and sell electrical apparatus. Promoters, Sam'l E. Moore, Louis S. Day and John Irvine.

Gaston Electric Manufacturing Company, Sparta, Ill., capital stock, $125,000; to manufacture and sell electrical and other machinery; promoters, J. E. Gaston, D. P. Barker and R. H. Rosborough.

Beatrice Light & Power Company, of Beatrice, Neb.; capital stock, $250,000; to construct and maintain gas and electric light works in Beatrice and other places in Gage county, Neb.; promoters, Fred J. Maxwell and Wm. Pickrell, Beatrice, Neb.

Berkeley & Lorin Water and Light Co., San Francisco, Cal.; capital stock, $250,000; to purchase, acquire, lease or otherwise, and sell water, water rights, light and power privileges and franchises. Promoters, W. L. Sheldon, Wm. F. Martin and J. A. Mallon, San Francisco.

The Carpenter Electric Light & Motor Company of the District of Columbia, of Washington, D. C.; incorporated in West Virginia; capital stock, $100,000; to deal in electrical appliances; promoters, H. H. Carpenter, J. E. Carpenter and J. T. Burch, Washington, D. C.

Harvey Transit Company, Chicago, Ill.; capital stock, $150,000; to construct and operate a horse or dummy railroad in Harvey, Ill., and to operate in contiguous territory by animal, steam, electric or other power; promoters, Hiram H. Badger, Chas. D. Stanwood and Willets G. Wanzer.

The following new companies have been incorporated: Columbian Light, Heat & Power Company, of Chicago, Ill.; capital stock, $3,000,000; to manufacture the apparatus to do a general light, heat and power business, and to buy, furnish, deal in and sell all such apparatus. The promoters are Newton A. Partridge, Samuel E. Moore and John Irvine.

LIGHT.

The Peninsula Electric Light Co., Detroit, last week elected H. Leonard Wilton secretary and treasurer.

Mr. Fisher, of the National Electric Mfg. Co., of Eau Claire, Wis., has secured the contract for an incandescent plant to be installed by Coldwater, Mich.

The Grand Rapids city officials are interested in electric lighting, and last week a delegation of twenty visited Detroit to look at its tower system. The Detroit aldermen acted as hosts and accompanied the visitors on a tour of inspection.

The Western Electric Company, of Chicago, will make quite a large exhibit of electrical apparatus at the National Electric Light Convention at Montreal. It has applied for 1,500 square feet of floor space.

Among the recent contracts of the Western Electric Co. are the following: Schlitz's Brewery, Milwaukee, 900-light incandescent plant; State House, Columbus, O., 500-light incandescent plant; Coldwater, Mich., 40-light low tension machine for street lighting and 40-light high tension dynamo for commercial lighting; Wheaton, Ill., arc light plant for street lighting; Portage, Wis., 50-light arc plant.

A foreign correspondent of Electricity sends this clipping from the London *Standard* relating to the electric lighting of the city of London: "The aspect of Queen Victoria street when the gas lights were extinguished was exceedingly cool and refreshing. The effect was very like moonlight, and although every object was plainly visible, there was perfect rest for the eyes. The contrast, standing at the corner of the junction of Cannon street and Queen Victoria street, was very great between the one street and the other. The deep darkness of the former, studded with here and there yellow stars, looked gloomy beside the latter street, which formed a streak of subdued radiance as far as could be seen. One central refuge has an arc lamp mounted a couple of feet higher than the others, and this seems to be the best of the series. The exhibition last evening was not a formal commencement of the lighting under the contract, but was a trial in view of obtaining the approval of the engineers to the city commissioners of sewers in the progress of the work."

POWER.

The United States Mint at Philadelphia has lately installed a 25-horse-power Eddy motor to run all the coining machines and several other devices. At present all the minor coins are being made by this motor. The steam machinery is being overhauled and the motor is doing the same work as done formerly by the engines. The officials are well pleased with the motor and will keep it in operation for a relay after the engines are repaired. The central Edison station supplies the current.

When the electric road was opened in Buffalo one of the local papers commented on the event in this wise: "May this electric railroad soon be followed by other electric roads! * * * Truth to tell, we did not want trolley lines very much. But now that we have them, we are disposed to make the most of them." This leads the Rochester *Herald* to remark: "If they are managed as successfully as similar lines in Rochester have been, you won't have much reason to complain. * * * As for the superiority of the electric system over the horse car no one whose judgment is worth a cent can entertain any doubts."

During last year the gross earnings from operation of the Rochester, N. Y., Railway Co. were $579,296.22, and the operating expenses were $364,091.97; the net income was $38,211.82. The statement is exceedingly satisfactory to the management. During the year the change from horses to electric motors was made and the operating expenses were increased, while on account of construction work the receipts were much less than normal.

The report comes from Milwaukee that a company has been formed to construct an elevated electric road from Chicago to that city. It is claimed that remarkable speed will be maintained.

Several electric railway projects have just been formed in Chicago. The Harvey Electric Railway Co. proposes to operate a motor line in Harvey. The Harrison Street and Desplaines River Electric Railroad Company has been organized to build a road from Western avenue and Harrison street to the Desplaines River. The Chicago South Side Electric Railway Company has found an alleged flaw in the charter of the Alley L road, and therefore asserts that the latter has no rights. The new company says it is ready to purchase the Alley L property and operate the road by electricity.

JOTTINGS.

It gives one something of an idea of the cost of the maintenance of a sub-marine cable system to read that the Eastern Telegraph Company expended in six months $235,000 for the repair and renewal of its cables.

A dispatch states that the present Connecticut legislature, before its final adjournment, is likely to consider the question of the substitution of electricity for hanging in the infliction of the death penalty in the state. With the vast number of protests against the New York method, which have been published throughout the country, it is hard to see why any legislature should desire to adopt the electrical method of inflicting capital punishment.

The new telephone building in Detroit will be built at the corner of Washington avenue and Clifford street. Work has already been commenced. The building will be six stories in height and will be constructed of brick. The first floor will be devoted to stores, all the others to offices, except the top floor, where the exchange will be located in a lofty and commodious apartment. The cost of the building, not including the ground investment, will be in the neighborhood of $100,000.

A good deal of fun was made of the Prince of Wales when, a few days after the baccarat scandal, he attended the Faraday Centennial, and manifested considerable interest in the event. It was reported by correspondents that he was posing, and that his idea was to create the impression that he was quite devoted to science. It is only fair to note, however, that the Prince's regard for Faraday dates back many years. After the death of the distinguished scientist he wrote the following letter, which has just been published: "Wiesbaden, September 10th, 1867.—Dear Mrs. Faraday- Although I have not the pleasure of knowing you, I cannot resist sending you a few lines to tell you how deeply grieved and distressed I am to hear of the death of your husband, Professor Faraday. Having had the great pleasure of knowing him for some years, and having heard his interesting lectures when quite a boy, I can fully appreciate how great the loss must be, not only to you, but to the whole country at large, where his name was deeply venerated by all classes. His name will not only be remembered as a great and distinguished scientific man, but also as a good man, whose excellent and amiable qualities were so universally known. Pardon my trespassing so soon on your great grief, and believe me, dear Mrs. Faraday, yours very sincerely, Albert Edward."

COMMERCIAL PARAGRAPHS.

The Weston Electrical Instrument Company, Newark, N. J., find a steady demand for Weston standard direct-reading voltmeters and ammeters for direct current circuits. Their wide range, simplicity and great durability have made them exceedingly popular.

The Great Western Electric Supply Co. will move August 1st from 190 Fifth ave., to Warren Springer building 201 to 207 South Canal street, Chicago. Its present quarters, although large, do not afford the facilities required by the company. In the new place of business the company will occupy the ground floor and second floor. It will have facilities for manufacturing staple supplies and specialties.

In these days busy men are quick to recognize the value of labor-saving office devices. Times have changed since the days when business papers were kept loose for awhile and then tied up in bundles and consigned to the "back room." The various devices manufactured by the Office Specialty Co., of Rochester, N. Y., and sold the world over, combine points of excellence that go to make up an ideal system. The Shannon files and cabinets, for instance, afford a perfect arrangement for filing bills and letters. Papers are thus absolutely secured against accidental loss and may be referred to with the greatest ease. The Shannon cabinet and the Rapid Roller Copier in use afford the best possible system of filing together letters and copies of answers.

Chas. A. Schieren, of the firm of Chas. A. Schieren & Co., New York, will start shortly on a trip to Europe. Mr. Schieren has a "good thing" in his electric and perforated electric leather belting for dynamos, and the electrical fraternity knows it.

The Crocker-Wheeler Electric Motor Company have found it difficult to keep up with its orders, but now that the reconstruction and enlarging of the factory, 430-432 West 14th street, New York, has been accomplished, will doubtless soon be able to meet the demand.

With an extra large force of hands engaged, the Electrical Supply Co. expect to soon emerge from the debris caused by their moving to 102-104 Michigan ave., and show their friends and customers one of the handsomest supply houses devoted to electrical goods in the west.

The old saying, that "it never rains but it pours," the Chicago Electric Motor Company thinks is well exemplified by the way orders are pouring in for its fan-motors. Although running the shop at its full capacity, the company is unable to keep up with the demand for cooling apparatus.

A good steam pump for boiler feed purposes is a necessity in every electric light and power station, and the "Davidson" seems to fill the bill from all accounts. A large number are used throughout the East with most satisfactory results. The establishment of the manufacturer, M. T. Davidson, 43-53 Keap street, is one of the busiest in Brooklyn.

Among water-tube steam boilers for electric light and power stations the New Root Improved is in great favor. The Abendroth & Root Manufacturing Company, sole manufacturers, 28 Cliff street, New York, report a good business, and their boilers warrant it. They are exceptionally well made, economical in the use of fuel, and rapid steam generators.

In the line of vulcanized rubber goods for mechanical purposes, the New York Belting & Packing Company, L't'd, 15 Park Row, New York, is one of the oldest, largest and best known manufacturers in the world. Its rubber belting and hose have made this concern famous, and it is but natural that they should be doing a large and exceedingly prosperous business.

The demand for electrical bells is on the increase and manufacturers are trying to see who shall have the trade in bells. As far as can at present be seen the Eastern Electrical Supply Co. of this city comes as near giving such things, for it is advertising a thoroughly reliable, guaranteed wooden box bell at the nominal price of *40 cents* each in lots of 50 or more.

Although it was quite recently that the flourishing Holtzer-Cabot Electric Co. located its chief offices at 111 Arch Street, Boston, it has already had to vacate for far more commodious quarters, which were found at 92 Franklin street, Boston. Here a handsome suite of offices have been furnished, for clerical staff, agents, managers of departments, and principals, while a large and handsome show room extends back nearly to the next street. When all the appointments are finished, the new quarters will be very attractive.

W. S. Hill, the veteran electrical engineer, of Boston, and manufacturer, continues to ship his popular switches and cut-outs in large quantities to all parts of this country and abroad. His latest device is a covered switch which is remarkably simple in construction, attractive in design and a marvel of cheapness. It is having a ready sale. Mr. Hill has just completed a 20 arc light plant at Rocky Point, R. I., which is giving the utmost satisfaction. The entire system was of his own design including the dynamo which is a most efficient machine.

As an indication of the prosperity enjoyed by the electrical firms of Boston, may be taken the fact that so many are finding it necessary to occupy more extensive quarters, while the desire for greater comforts is strikingly apparent. Among these changes and improvements are the new executive offices of the Eastern Electrical Cable Company, Hampshire St., Roxbury, Boston. The company recently purchased the foundry premises adjoining its factory and on a spare piece of ground, included in the purchase, a handsome office building has been erected. The offices themselves, which were planned by H. H. Eustis, president of the company, included a large office finished in light wood, with massive oak furniture, private office similarly equipped, long distance telephone room, lavatories etc., etc. This company has to run its plant night and day to keep pace with the demand for its special brands of wires and cables, which are popular everywhere.

ELECTRICAL PATENT RECORD.

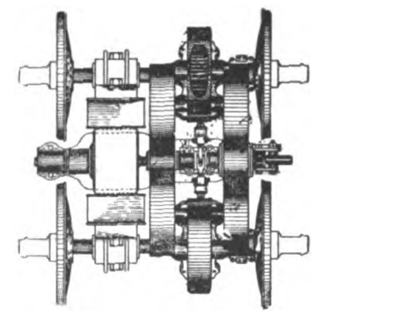
LETTERS PATENT ISSUED JULY 7, 1891.

ELECTRIC RAILWAYS.

455298. Electric locomotive. Norman C. Bassett, Lynn, Mass. Application filed Oct. 30, 1890.
In this locomotive the electric motor extends from axle to axle of the truck, and is mounted thereon by spring bearings. Upon the armature shaft of the motor there are placed variable friction pinions, which engage corresponding friction wheels fixed upon a countershaft, which shaft is geared to and swings about the axle as a center.

455322. Trolley Pole Stand. James R. Griffiths, Allegheny, Pa. Application filed Jan. 20, 1891.
This patent shows a form of trolley stand by means of which the trolley pole is free to move or swing in several directions.

455339. Conductor for Electric Railways. Walter H. Knight, Cleveland, Ohio. Application filed May 11, 1885. The last claim is:



PATENT No. 455,298—ELECTRIC LOCOMOTIVE.

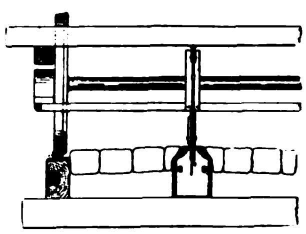
"25. In an electric railway the combination of an inclosing conduit, a supply conductor, a vitreous insulator having a spring bearing, and a deadener therefor."

455340. Electric Railway. Walter H. Knight, New York, N. Y. Application filed May 11, 1885.
This invention consists in a contact device carried by the vehicle having its outer extremity pressed into contact with the line conductor, and guided along it, and its inner extremity having a free laterally moving and swiveling connection to the vehicle, permitting all the necessary movements to accommodate the device to the irregular path followed by its opposite ends, respectively.

455341. Electric Railway. Walter H. Knight, New York, N. Y. Application filed April 29, 1887.
This patent relates to details of construction of conduit systems of electric railways.

455342. Electric Railway. Walter H. Knight, New York, N. Y. Application filed Oct. 16, 1888.
This invention relates to electric railways in which the supply conductor is enclosed in a slotted conduit outside of the track; and it consists in a conduit of this nature in which an ordinary girder track rail is also used for one of the slot-rails.

455343. Electric Railway Plow. Walter H. Knight, New York, N. Y. Application filed March 5, 1889.



PATENT No. 455,340—UNDERGROUND ELECTRIC RAILWAY SYSTEM.

455447. Conduit for Electric Railways. William Bradley, Fort Wayne, Ind. Application filed Nov. 24, 1890.
This invention relates to improvements in conduits for electric railways, and its objects are to provide an improved conduit which shall better prevent the entrance of foreign substances into it, and which shall be more convenient in its construction and economical in use, and also to provide an improved switching device in connection therewith.

455454. Electric Railway. Edwin W. Rice, jr., Lynn, Mass. Application filed March 30, 1891.
In this system two supply conductors attached to separate generators, and parallel with the road, are each at separate times made to propel the car by means of a suitable arrangement which brings the propelling motor in circuit with either of them at one time.

DYNAMOS AND MOTORS.

455517. Multipolar Dynamo. Andrew L. Riker, New York, N. Y. Application filed Feb. 7, 1891.

455581. Electric Motor Car Truck. John F. Sieberling, Akron, Ohio. Application filed March 9, 1891.

455711. Electric Motor. Lemuel G. Goode, Jersey City, N. J. Application filed Aug. 22, 1890.
This invention relates generally to electric motors, but more particularly to a reciprocating electric motor—that is to say, to an electric motor in which the moving armature reciprocates or oscillates back and forth within certain limits, in contradistinction to those which rotate.

455726. Electric Motor and Generator. Walter F. Brown, St. Paul, Minn. Application filed Aug. 21, 1890.
The object of this invention is to provide an electric machine of economical construction, superior efficiency, and adapted to be rotated in either direction.

455488. Friction Gearing for Dynamos. Frederick L. McGahan, Indianapolis, Ind. Application filed Dec. 26, 1890.

LAMPS.

455366. Combined Fuse Block and Incandescent Lamp. Horace E. Swift, Boston, Mass. Application filed Sept. 29, 1890.

455559. Lamp Socket and Switch, and Circuit Closer Therefor. Henry P. Ball, Brooklyn, N. Y. Application filed Dec. 16, 1890.

455576. Electric Arc Lamp. Johan W. T. Olan, New York, N. Y. Application filed Jan. 12, 1891.
Claim I. reads:
"The combination with the carbons or electrodes of an arc lamp and inclosing globe therefor, of a tube extending from the base thereof and containing a column of liquid, said column supporting one of the lamp carbons and means for separating the carbons to form an arc.

TELEGRAPHY.

455330. Telegraph Key. Robert W. Green, St. Thomas, Canada. Application filed Feb. 10, 1890.
The key is arranged to close circuit without depending upon circuit break.

455398. Quadruplex Telegraphy. Charles D. Haskins, Brooklyn, N. Y. Application filed Nov. 19, 1887.
This invention is designed to avoid the false signal, which is a well known defect in quadruplex systems of telegraphy.

TELEPHONY.

455722. Support for Telephones. William J. Meyers, Allegheny, Pa. Application filed June 3, 1890.

MISCELLANEOUS.

455316. Annunciator. Manias Garl, Canton, Ohio. Application filed Sept. 26, 1890.

455352. Electrical Watchman's Clock. Harvey S. Park, Chicago, Ill. Application filed July 1, 1890.

455410 Watchman's Time Detector. Abraham Newman, Brooklyn, N. Y. Application filed March 11, 1890.

455420. Method of Electric Welding. Elihu Thomson, Swampscott, Mass. Application filed Feb. 19, 1891.
In this method the metal is cooled just back of the weld and between the same and the places where the current bearing electrodes form contacts.

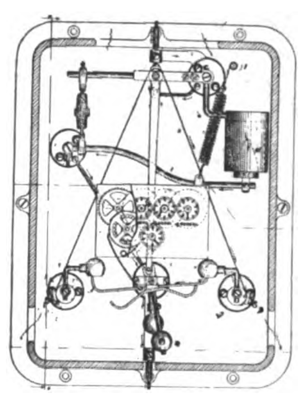
455421. Securing Metal Bands on Wooden or Other Articles. Elihu Thomson, Swampscott, Mass. Application filed Feb. 24, 1891.

455440. Watchman's Time Recorder. John A. Lannert, Cleveland, Ohio. Application filed Jan. 5, 1891.

455446. Grave Annunciator. William H. White, Topeka, Kan. Application filed May 22, 1890.

455451. Diaphragm for Electrolytic Cells. Ernest A. Le-Sueur, Ottawa, Canada. Application filed June 9, 1890.

455510. Train Signaling Apparatus. Linwood F. Jordan, Somerville, Mass. Application filed Nov. 16, 1889.



PATENT No. 455,524—ELECTRIC METER.

"I. The combination, with a source of pulsating or rising and falling currents, of an electro-magnetic reciprocating engine having a motor coil or coils and a magnetic piston moved within the coil or coils in synchronism with the rise and fall of energy therein, substantially as described."

455518. Carbon Brush and Holder Therefor. Andrew L. Riker, New York, N. Y. Application filed March 25, 1891.

455520. Pulsating Current Reciprocating Electric Engine System. Charles J. Van Depoele, Lynn, Mass. Application filed March 23, 1889.
Claim I. of said patent is as follows:

455524. Electric Meter. James J. Wood, Brooklyn, N. Y. Application filed Oct. 30, 1890.
This invention relates in general to meters for measuring the consumption of electricity, its general objects being to increase the range between the maximum and the minimum currents which can be measured, and to bring the rate of measurement or indication into more exact proportion to the rate of flow of currents of varying volumes.

455532. Self-winding Electric Clock. Fred L. Gregory, Niagara Falls. Application filed April 2, 1891.

455545. Electrical Walking Toy. John B. Kibler, Minneapolis, Minn. Application filed March 17, 1891.

455575. Electric Meter. Johan W. T. Olan, New York, N. Y. Application filed Dec. 29, 1890.
This invention relates to devices for measuring electricity by means of a rotator propelled by gas produced by decomposition of an electrolyte by the current or by a known fraction of the current to be measured.

455631. Apparatus for the Defecation of Saccharine Juices by Electricity in the Manufacture of Sugar. Elias Maigrot and Jose Sabates, Havana, Cuba. Application filed April 15, 1889.

455680. Electric Belt. Charles A. Bogardus, Syracuse, N. Y. Application filed Feb. 24, 1891.

455683. Transmission of Alternating Currents of Different Phase. Michael Von Dolivo Dobrowolsky, Berlin, Germany. Application filed March 28, 1891.
This invention relates to the transmission of alternating currents whose respective phases succeed each other, or differential-phase currents, to distant points of consumption; and its object is to utilize the advantages presented by causing a large number of alternating currents of the said kind to be produced by the generators, and to act in the motors, etc., without being obliged to employ an excessive number of transmitting mains.

455693. Galvanic Battery. Henry C. Sample, Ravenswood, assignor to Hugh W. Mathews, Chicago, Ill. Application filed Dec. 2, 1889.

455696. Switch-board for Electric Fence Stations. David H. Wilson, Normal, Ill. Application filed Aug. 25, 1890.

ELECTRICITY.

VOL. I. CHICAGO. JULY 29, 1891. NEW YORK. No. 2.

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BUSY MEN

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Electricity

ELECTRICITY.

VOL. I. | CHICAGO. | JULY 29, 1891. | NEW YORK. | No. 2

FINISHING INCANDESCENT LAMPS.

(*See page 17.*)

EXTERIOR LIGHTING EFFECTS AT THE MADISON SQUARE GARDEN, N. Y.

The handsome new Madison Square Garden building, New York, is rapidly approaching completion. It comprises an amphitheatre, a music hall and a theatre, and some idea of its extent may be formed from the fact that it occupies a whole block, and cost three million dollars. The exterior is constructed of cream colored brick and terra cotta, in the Renaissance style, and the entrance on Madison avenue suggests the facade of the Grand Opera in Paris. The pillars supporting this entrance are of polished granite and the entrance hall and porch are of marble, with mosaic floors, while the staircases throughout are of stone and marble. As might be supposed such a building presents exceptional opportunities for effective illumination, and these have been taken advantage of to such an extent that at night the building presents one of the most striking spectacles in the city. On each corner of the tower, which is already over 300 feet high, and which when finished will rise to a height of 380 feet above the sidewalk, there is a torch holder of highly polished brass. In each of these receptacles are placed twenty-four 32-c.p. incandescent lamps. Above each torch hangs a Ward arc lamp, and the electrical equipment of the tower further includes two Huntington search lights. The flood of light which is nightly shed over the city can be seen for many miles in every direction, affording a most beautiful example of the brilliancy and penetrating effect of powerful electric lights. When the tower is completed an immense arc light of some 17,000 c.p. will be fixed on a shaft rising from the top platform. This light, which will be visible forty miles out at sea, will be suspended over the head of a colossal ballet girl, whose relatively attenuated skirts will be seventeen feet long. Lights of smaller power, including 20 Ward arc lamps, are placed at other points of vantage throughout the building, and along the porches and entrance halls.

The interior of the building is lighted entirely by electricity, and is consequently remarkably cool. The amphitheatre alone contains over 2,000 incandescent lamps.

The dynamo room, which is built under the sidewalk, measures 20 by 100 feet. This department differs in a striking manner from the generating room of other isolated plants in respect to ventilation, which is effected most satisfactorily by fans driven by Crocker-Wheeler motors.

The plant consists of four No. 20 Edison dynamos, of a capacity of 900 lights each, run by two New York Safety Steam Power Company's engines. On one engine are used belts of the Shultz Belting Company, St. Louis, and on the other the belts of the Jewell Belting Company, Hartford, Conn. The boilers were furnished by Baker & Smith, New York. In addition to the lighting effects, current is also supplied to a large number of fans distributed among the offices and rooms throughout the building.

Madison Square Garden at Night.

FRANKLIN AND THE ROYAL SOCIETY.

In a sketch of the Royal Society of England, recently published, the following reference to Franklin is made:

In 1756 Franklin was elected a fellow of the society, and while in England he was a very active member and contributed several important memoirs. His electrical discoveries, as is well known, attracted great public attention, from their practical application, and led, indirectly, to the most ridiculous, but by no means the least bitter, of the quarrels from which the records of the Royal Society are no more free than are those of most other human institutions.

In 1769 a committee of the society was appointed to advise the dean and chapter of St. Paul's upon the best manner of protecting the cathedral from lightning, and under the directions of the committee, arrangements, as efficient as the knowledge of the time enabled them to be, were made for the purpose. In 1772 a similar committee was appointed to report on the best means of protecting the Purfleet powder magazines. In their report they very properly recommended pointed conductors, but one member of the committee, a Mr. Wilson, dissented from this proposal and declared that all lightning conductors should be fitted with knobs on their ends.

Mr. Wilson, being a person of influence, managed to get his views taken up by the Board of Ordnance, and he was assisted by the fact that the Purfleet magazines were actually struck by lightning. No doubt this trumpery dispute would never have attracted the slightest attention, but the discoverer of the effects of pointed conductors was Franklin. Franklin was an American, and the dispute with the American colonies was then at its height. No good patriot, consequently, could admit any merit to exist in a pointed lightning conductor. The question became a popular one. As in Lilliput, people became big-endians or little-endians, and for as valid a reason. George III. himself took a side, ordered the points to be taken off the royal conductors, and bade Sir John Pringle, then the president of the society, support Mr. Wilson. Sir John is credited with the dignified response, "Sir, I can not reverse the laws and operations of nature," to which the king, naturally incensed that so incompetent a person should hold so important an office, responded, "Then, Sir John, perhaps you had better resign," which Sir John did.

OPENING OF THE KANKAKEE ELECTRIC RAILWAY.

A party of Chicagoans organized by W. R. Mason, of the Electric Merchandise Company, and J. L. Barclay, of the Westinghouse Electric & Manufacturing Company, visited Kankakee on Saturday last to attend the formal opening of the electric railway in that city. The party remained until Monday, and had a most enjoyable time. The visitors were under special obligation to Charles A. Cobb, general manager of the road, who entertained them in a most hospitable manner.

The Kankakee road at present comprises about four and a half miles of track. The Johnson rail is used, and the tracklaying was done by Charles E. Loss & Co., of Chicago. The overhead construction was in charge of W. W. Hatch, and the entire line equipment was furnished by the Electric Merchandise Company, of Chicago. The cars, which were built by the Pullman Company, are mounted on McGuire trucks. Westinghouse twenty-five horse power single reduction motors are used on the cars. Western Electric generators furnish the current. Four cars are now in operation, but the number will soon be increased.

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Communications relating to subjects within the province of this journal are cordially invited. News notes, descriptions of new devices with drawings or photographs, are at all times desired.

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ELECTRICITY.

THE most flattering reception was given to the first number of ELECTRICITY, which was issued last week. For the host of complimentary letters from advertisers and subscribers, and for the appreciative notices of the press, we return our heartiest thanks. If additions to our subscription list and inquiries for advertising rates afford grounds for an opinion, we are justified in asserting that the success of the paper was assured by the first number. We shall spare no effort so to conduct ELECTRICITY as to merit fully the praise which has been bestowed on it, and to realize the kind predictions of its friendly critics.

* * *

THE citizens of Boston will soon be afforded an opportunity of making an extended trip on an electric railway. According to our Boston correspondent it will be possible in the near future to take a continuous ride of thirty miles under a trolley wire.

* * *

THE value of the electric search light was amply demonstrated in the maneuvers of the White Squadron, in New York harbor, last week. By the aid of the intense light from the projectors it was possible for those on board the cruisers to ascertain the proximity of torpedo boats. Electricity is adding greatly to the efficiency of the navy, and perhaps its most interesting application is the search light.

* * *

THIS is a season of important legal decisions. This time the accumulator question is decided by Judge Coxe, who has heretofore familiarized himself with storage battery litigation. The decision is in favor of Mr. Brush, and some of the results of the judgment of the court are summarized in our New York letter. One result, it is stated, will be that the storage battery cars on the Fourth and Madison Avenue line will soon be in operation again. That fact certainly will be gratifying to all interested in electrical work.

* * *

MR. PERRY concludes his excellent article on the electric street railways of Cincinnati this week. One of the curious conditions in that city of curious electric railway construction, is that which permits two different double trolley systems to run over the same track. In regard to the relative merits of the double and single trolley systems, it is useless to argue in Cincinnati, according to Mr. Perry. Both systems have been found so excellent in practice that the advocates of one method refuse to be convinced by any argument as to the superiority of the other.

* * *

IT is not frequent that a woman's name appears in the patent columns of electrical journals. Once in a while it creeps in, and certainly one person is classed as an "Electricienne" in an electrical directory. Women, however, have been very prolific inventors. Three thousand letters patent have been granted to American women for inventions ranging all the way from stays to war vessels. While woman has thus far participated only to a small extent in the inventions of electrical devices, she is performing a most important part in manufacturing patented electrical devices. This statement is particularly true as it relates to the lamp industry. In this issue appears an article by "Nell Nelson" on the important part played by girls in this field. The author will be well remembered as the ardent and sometimes almost sensational champion of the working girl. Her articles relating to the extremely objectionable conditions under which women worked in factories created somewhat of a surprise and sensation both in Chicago and New York. The electrical factory receives from the author only unstinted praise, and for the girl employes she expresses the highest admiration for the marvelous rapidity and dexterity with which they perform their delicate work.

* * *

THE New York newspapers have been fairly bidding for the honor of indictment for disregarding the law providing that the secrecy surrounding the taking-off of murderers by the electrical method shall not be violated. It has seemed as if it was impossible to break the law, for the papers did their best, and yet the authorities were apparently determined not to notice the most flagrant violations. As one paper put it, "If all laws, human and divine, were as difficult to break as the press clause of the electrical execution law, sinners would be in demand at dime museums." At last, however, the editor of one paper has forced himself upon the prosecuting officers as a victim, and it looks as if the constitutionality of the "gag clause" would be tested. We do not believe in electrical executions. The method is objectionable, if for no other reason, because it involves so many complications; but if it is to be experimented with, we would like to be furnished information by which to judge whether it has any commendable features.

* * *

IN an article in the *North American Review* on the "Possibilities of the Steam Yacht," reference is made to the use of electric launches. While the application has been successful, high speed, it says, has not been attained. "Yet," it is added, "it would be unwise to say in the face of the astonishing advancement in electrical science, that it [electricity] may not answer some special requirement." This is, perhaps, a fair statement of the case. The electric launches on the Thames are doing all that could be expected of them. The fact that the fleet is constantly increasing is the best proof of its excellence. There were sixteen of them on the river at the time of the Henley regatta three weeks ago. No one expects yet that the launches will go many leagues away from the charging stations. It is imprudent to venture any predictions about absolute impossibilities in the application of electricity; so the writer of the extract quoted showed proper caution in adding the saving clause. But a deal of nonsense has been written about the application of electricity for propelling vessels. When the Charleston failed to overtake the Itata a short time ago, a daily contemporary gravely spoke about the present possibility of using electrical machinery for increasing the speed of warships. Presumably the writer expects that vessels would secure their current from the submarine cables.

* * *

IF the electric lighting plant at the World's Fair ground is to be completed by the time that illumination is required, an extraordinary amount of work must be accomplished in a comparatively brief space of time. The preliminary work to be done is fairly appalling. The amount of light needed in all the buildings on the ground must be ascertained, subways must be planned, and the amount of power for machinery must be determined. Not to mention other preliminary tasks, the satisfactory determination of the three problems indicated will involve so much of labor in arranging details that the longest time that can be given to the work will seem extremely brief. In the machinery annex, located in the southwestern part of the Fair ground all the electric generating apparatus will be installed. It is difficult to estimate how large a plant will be required, but if it be assumed that 20,000 horse power is necessary, the estimate will probably not be over 10 or 15 per cent. out of the way. What company would like to complete the installation of a plant of this kind in much less than two years? Yet it is a fact that the machines should be in thorough running order by October 14 next year, when the imposing inaugural ceremonies will take place. As far as can be ascertained, practically nothing has been done toward this end. Electrical companies are waiting until preliminary plans for this department are formed before determining what they will do in the way of exhibiting apparatus. A great many of them doubtless will install machines as exhibits in this annex, and will receive from the Exposition company some sort of compensation for operating them. This will be the first question for decision; when it is determined the companies can plan what they can afford to place in the electrical building proper. The time before the World's Fair is short at best, and it should be economized as far as possible. Electrical companies throughout the country are disposed to make liberal displays of their apparatus, but they should be given all the time possible to make their preparations. We sincerely trust that this statement will not be regarded as written in a fault-finding spirit. We are too much interested in the World's Fair in general and in the electrical department in particular to say aught that might in any way tend to prejudice its interests or be construed as hostile criticism.

ELECTRICAL BELLES.

BY HELEN CUSACK (NELL NELSON).

Electricity has added enormous territory to the widening field for woman's work. Electricity, in revolutionizing the world, promises to lift our working girls out of the bondage of industrial slave drivers, and out of the factories and sweating shops and clerkships, where greed and avarice murder the moral and social life. Every city can not boast of an incandescent lamp factory, yet every city in the Union uses electric lamps, in the manufacture of which hundreds of young women find regular and remunerative employment in America and in the European capitals where electrical plants have been placed.

This work means a great deal more than mere employment and wages to women. It means educational encouragement, sanitary reform and health conditions hitherto neglected by capital and disregarded by labor.

Of this new and better order of things no better illustration can be afforded than the lamp factory of the Sawyer-Man Electric Company on West Twenty-Third street, New York, where the full

SEALING THE CARBONS IN THE BULBS.

working force numbers about 400 girls. It would be impossible to find a more desirable condition of affairs, industrially, socially, or morally, than can be found there. The building is an immense brick structure, not handsome, but a revelation to anyone familiar with the barracks called factories, in which laborers are often immured, in New York. Ventilation is perfect, and so is the system of heating; windows are abundant. The light for the most part is admitted through glass roofs, and the result is cool work-rooms during the summer, warm ones in cold weather, and light, airy shops at all times. Innumerable contrivances are in constant use for the consumption or escape of the gas and chemicals which otherwise would be, and ordinarily are, destructive to health.

The girls who prepare the carbon burners, who treat, mount and cement them; who examine, repair and sort them when finished; who seal them in the glass bulb, mount the bulb on the brass base, and then test the lamp, to see that it is perfect, are for the most part Americans, either by birth or adoption. A Swede, German, Dutch or Irish girl who has recently come to the country may apply for work, but the chances are that she will not prove available, for the reason that she is likely to be clumsy. Hard and unremitting toil, such as the poor children of Europe are subjected to at a very tender age, robs their fingers of their cunning. They may, at the age of 16 or 18, wield a churn, a broom, a spade, or scrub brush, or guide a plow with skill, but a filament the thickness of a hair, a fork of tendril-like wire, or a glass bulb of egg-shell delicacy, could scarcely be handled by them with skill and safety. Even if breakage is not greater, deft fingers are more valuable than clumsy ones in this work, and the dexterity and delicacy of touch which comes naturally to the city girl has operated so much in her favor that she has practically almost monopolized the work in electric lamp factories.

In the selection of hands the employer is guided very much by appearances. As a rule, the new hand is recommended by one of the old employes, and thus an additional guarantee of respectability is obtained. There is no catechising of the applicant, and no references as to moral character are required, as in Mr. Wanamaker's dry goods store. If a girl has "snap," if she looks tidy and respectable, and if she is willing to work, she is given a chance. If she does not suit, she is dismissed. The manager finds that this method of selection answers admirably. As a matter of fact the moral standard of the applicants is excellent, but something more is required for the manufacture of electric lamps. The forewoman who has charge of the carbon department in the factory, and who in all probability knows more about electricity as applied to carbon filaments than any woman in New York, has a sort of kindergarten where the girls are trained for the work. Every year she instructs a large number of young women, of whom only 20 per cent. are finally rejected. Some will be refused work on account of defective eyesight. Very accurate measurements are required in cutting and telling the carbon before it is cemented, and a true, quick eye is as necessary as a delicate touch. Some girls have poor health, which would be a drawback, especially at the instruments where the operator works over a constantly burning jet in order to seal the lamps or solder the wires. Clumsy hands that show no tendency to grow flexible cannot be retained, as the most painstaking and careful novice will break more material the first few days of employment than her salary would cover in a week. Then there are the slipshod, untidy girls who are rejected after a few hours' practice, and the giddy girls who are too flighty to be trusted at any instrument or desk.

In the matter of age the forewoman draws the lines at 16 and 35 years. Before 16 she finds the average girl too giddy to be relied on, and after 35 her fingers are apt to be rigid and her speed generally limited. There is no department which cannot be mastered in a month, and the details involved are as a rule so simple as to be understood after a few days' practice. Each branch of the work is independent in character, and a knowledge of one in no way depends upon practice in the other. Any girl who can play on the piano, use a typewriter, do embroidery or any other work requiring flexibility of finger, could readily become an expert in making electric lamps.

Eight years ago, when the Sawyer-Man factory was opened boys were employed. They took to the work at once, fascinated by the instruments, a few lessons sufficing for their instruction. They did good work, true in every particular, and the loss by breakage was almost insignificant. But they were slow, too slow for the trade, which required millions of lamps in dark weather, the average life of a carbon being 800 hours. As an experiment, and after numerous mechanical improvements had been made, girls were employed, and for a time it looked as though they were undesirable. First of all, they were afraid of the electrical machinery. They were in constant fear of an explosion or a shock. They squealed a great deal, jumped about and ran away, and had to be coaxed back to the instruments. Even after confidence had been established, they showed a woman's density in mechanical matters, and nearly twice as much time was required to teach them as the boys. And then the breakage! No dish cracker or pantry maid could approach them in the destruction of filaments and crystal. They laughed at the debris; the president was puzzled and the manager looked grave; but when the fair electrical artisans were threatened with fines to cover their losses, there was a change. The giggling stopped and so did the smashing, and when the girls settled down to work and began to palpably increase the turn-out, the company dismissed the boys with a week's pay in advance and advertised for 300 girls. That was in 1883 and ever since the girls have had the industry to themselves. It is impossible to imagine the skill of these electrical belles without seeing their work. They are not only dextrous but ambidextrous, and they will hold a mounted filament or a glass bulb in the left hand, manipulate a pair of pliers with the other, and twirl them backwards and forwards so fast that you wonder what it is all about. A mount maker will take two pieces of platinum wire 1⅜ inches long and as fine as a pair of your eye lashes, put them in a smelting holder, slip on two small glass beads, and turn them into a fork, at the same time dotting or marking them to distinguish the voltage. She works over a fire made by four gas burners, with air pressure and works like lightning, making and marking 500 mounts a day.

At the start her fingers are burned a great many times, but after a few weeks she mounts and dots in a playful, graceful way that is quite fascinating as she hums to herself some jingling tune. In the busy season 40 girls are constantly employed turning out 20,000 odd mounts a day for a corresponding number of lamps. Some idea of the skill of these workers can be imagined when it is stated that not three carbon mounts will be lost in breakage in a hundred. Considering the extreme delicacy of the platinum wire, the brittleness of the glass beads, and the intensity of the heat concentrated in the heart of the flames, this is truly remarkable.

In the cementing department, where the junc-

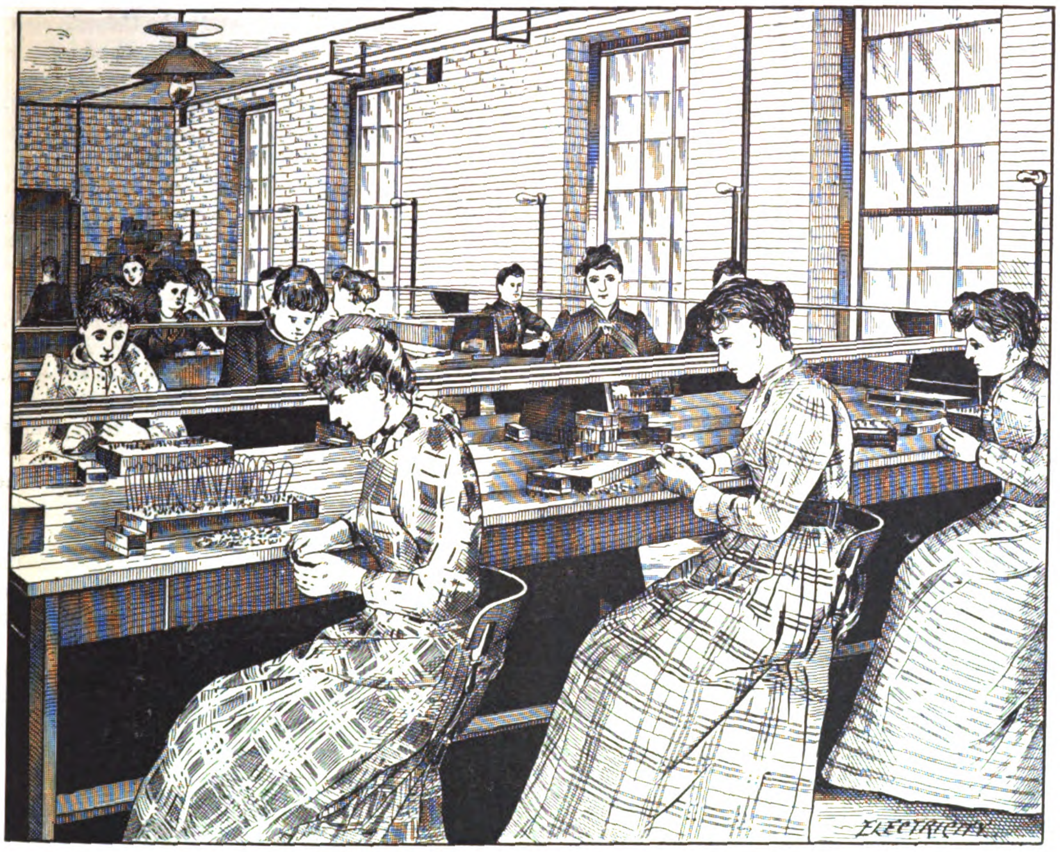
tion between the filament and the platinum wire is perfected by the deposit of a small ball of carbon in order to make a perfect electrical connection between the filament and the platinum, the girls are equally skillful. Some form of hydro-carbon fluid is used in the process, the only disagreeable feature in the carbon work, but the contrivances for carrying off the gas are so perfect that the odor is barely perceptible.

In forming the mechanical twist for the even diffusion of light, the operator takes the work from the cementing apparatus, and so deft is her touch that she will use a pair of pliers on the almost invisible wire and not break five in a thousand. She must examine the filament, see that the connection is perfect and the mount ready to be delivered to the glass blower.

The girls who handle the carbonized silk would consider the wing of a butterfly clumsy. Indeed the filament is so very fine that keen eyes are necessary to see it. These delicate threads pass through six measuring instruments for the determination of the resistance of the carbon, and aside from the extreme delicacy of touch, the girl must know how to read the instrument, the task of a day's study. Only dexterity is needed in treating the carbon filament, the process being as simple as the taking of snap shots with a Kodak, but these light-fingered girls will handle thousands of the web-like threads in a day and with hardly appreciable loss. After the carbon has been introduced into the mount, it goes to the lamp maker, and one looks with dumb admiration at the girl who takes the glass bulb in one hand, melts the end over a gas flame, and, with a pair of pincers in the other, cuts away the edge, inserts the carbon and seals it up, all in a jiffy and with a grace of movement that a Delsarte would have envied. She handles the glass bulbs like paper and seems to kiss the end, when, in reality, she is blowing into the bulb. Each girl will seal, say, a couple of hundred lamps in a day, and seal them perfectly, knowing that if not air-tight they will come back, and it is a most unusual thing for one to be broken.

In mounting the lamp on the base the cleaning is done by polishing with moist tissue, the girls here, as elsewhere, being delicate of touch.

In all departments the employes are provided with comfortable seats; they breathe a clean, wholesome atmosphere, and their surroundings are convenient and pleasant. There is not a rule or a regulation on the wall, with the exception of a few notices of a mechanical nature and those referring to fire.



MOUNTING THE FILAMENTS.

The girls are nice, not only in appearance but reality. They are far above the average in intelligence and they show the effect of considerate and kind treatment. In all the industries of New York it would be difficult to find more wholesome conditions, prettier girls or more harmonious relations between employer and employe than are to found in this factory. If the salaries are not as large as might be desired, the work is not laborious. A school teacher getting $1.25 a day, a machine operator making ladies' shirt waists at $1 a dozen, or a saleswoman "clerking" for $4 a week, will do more hard work and suffer greater mental and physical exhaustion in one day than a lamp maker will in ten.

Beginners get 8 cents an hour or 80 cents a day although in the first two or three days' instruction they will make havoc with the stock. After becoming skilled they are paid by the piece. In the carbon department girls who work two months become reasonably apt and make from $4 to $8 a week.

Special workers who repair, examine and keep account of the stock, sort of general utility women get from 8 to 12 cents an hour.

Lamp makers, who seal the carbon in the bulbs, work by the piece, prices differing according to the size of the lamp. By diligent work $10 can be made, but $5 to $6 is the average pay for a week's work.

Mount makers in the same department are paid by the piece. Little skill is required and wages average about $6.

Finishers, who measure and mark the lamp, examine, clean and deliver goods to the stock room, are paid by the piece and average $5 to $6.

General examiners, inspectors and cementers, who become proficient in a week's time, get $5 to $6; solderers receive $6; expert testers are hired by the day and get from 8 to 16 cents an hour, according to the length of service and skill; while the girls who clean the glass lamps when finished make from $4 to $6 a week. Ten hours is a day's work and there is a half holiday every week. There are no fines, no assessments for ice water or soap, and no interference with personal rights. The girls have nicely appointed dressing rooms and lockers, and there is a gas stove where they heat coffee and boil eggs for their luncheon. They have their private entrance to the building and they are treated with marked respect by every man and youth in the concern.

Employment of women by electrical companies is going to have a wholesome influence socially as well as industrially. The best element is levied on; there is room for improvement and advancement, and no girl who has ever worked for a concern of this sort would slave even for bread under the inhuman and demoralizing influences of the average factory. The song of the shirt has not been sung in vain, but its era is past. The needle has done its work, the suicidal sewing machine has had its day, and the rank and file of the woman clerks, who keep stock for $3.50 a week, hope for salvation. What are known as the genteel vocations—dusting bric-a-brac, making tissue paper flowers, shopping, mending lace and silk socks, putting up fruit and filling orders for salad dressing, seed cakes and sandwich pastes—will lose their charm when young women know that steady employment, and light, clean work can be found in the magical fields of electricity. Men have made the world move and it looks as though they were going to solve the woman question.

To give hundreds of American girls an opportunity of making an honest living is to wield a powerful and beneficient social influence, and that is what the electricians are doing.

NATIONAL ELECTRIC LIGHT CONVENTION.

One of the features of the convention of the National Electric Light Association, at Montreal, will be a conversazione at McGill College. At a meeting of the Montreal committees a few nights ago, Prof. McLeod and John Carroll, of the Eugene F. Phillips Electrical Works, were appointed as a committee in charge.

It looks as if the delegates at Montreal would have little spare time while there. The committees are talking of banquets, and garden parties, entertainments and excursions to all the interesting points about the city.

The annual clambake tendered by the American Electrical Works, Providence, R. I., to the electrical fraternity will be held on Saturday, Aug. 8th, and it goes without saying that the fraternity is anticipating with pleasurable feelings the celebration of this, the most delightful day in the electrical year. Given a fine day and there will be a lively, rollicking party at beautiful Vue l'Eau, the old trysting place.

Where will the winter convention of the association be held? It has rather been assumed that Buffalo would be the city, but here comes a suggestion from the Chattanooga *Times:* "The National Electric Light Association, composed of the presidents, managers and superintendents of all the electric light companies of America, have heretofore held their annual meetings in the North, but they now think the South is entitled to the next meeting. Naturally they look to Chattanooga as the proper place to hold a convention. An effort should be made to induce the association to meet here, as it will bring a large body of representative men together who would carry away with them good words for Chattanooga to all parts of the Union."

The heretofore talked of electric railway between Elgin and Aurora, Ill., through St. Charles, Geneva and Batavia, is again being seriously considered. Such an enterprise would be a great convenience to many residents of these cities. Aurora and Elgin street car magnates are thinking the project over.

ELECTRIC RAILWAY SYSTEM OF CINCINNATI.

BY NELSON W. PERRY.

Concluded.

When the Colerain Avenue road was first started a single trolley mast, forked at the end, was used.

This, however had to be abandoned, as in going around curves or over irregularities of the track, if one trolley wheel accommodated itself to the conditions of its wire, the other was pretty sure not to meet the different requirements of the other wire, and one or both would get off. When the conductor tried to replace them, if the distance between the wheels did not exactly correspond with the distance between the two wires, or if the latter in vibrating happened to be in different phases, there was trouble and profanity. Two separate masts, each acting independently and capable of adjusting itself to the conditions of its own wire, however much they might differ from those of the other, were substituted, and while they look more clumsy, answer every purpose, and it is a rare thing now for either of them to go astray, and when they do they are as readily replaced as in the single trolley system.

At one place on the Colerain Avenue route, there is for a distance of one block but a single track over which cars go in both directions. For this distance the four wires are brought close together over the single track—two being used by the cars going up and two by the cars going down.

The telephone injunction suit before referred to was an attempt to compel the Mt. Auburn single trolley road to use the double trolley. They, in self-defense, of course, endeavored to show that the latter system was not feasible, and I presume that every objection, real and imaginary, that could be thought of, was raised. Actual experience alone could answer many of these, and at that time it was in many cases wanting. It is now at hand. One of the objections was that a double trolley could not round a short curve.

The Colerain Avenue road is daily running 25 motor cars with trailers around 20 curves of 33-foot radius and upward, on each round trip.

Another was that two double trolley roads could not cross each other, nor could suitable switches be provided where needed.

This same road crosses itself twice and every car in its rounds has to pass three switches.

The same thing is successfully done a number of times on the Covington and Cincinnati and other double trolley roads.

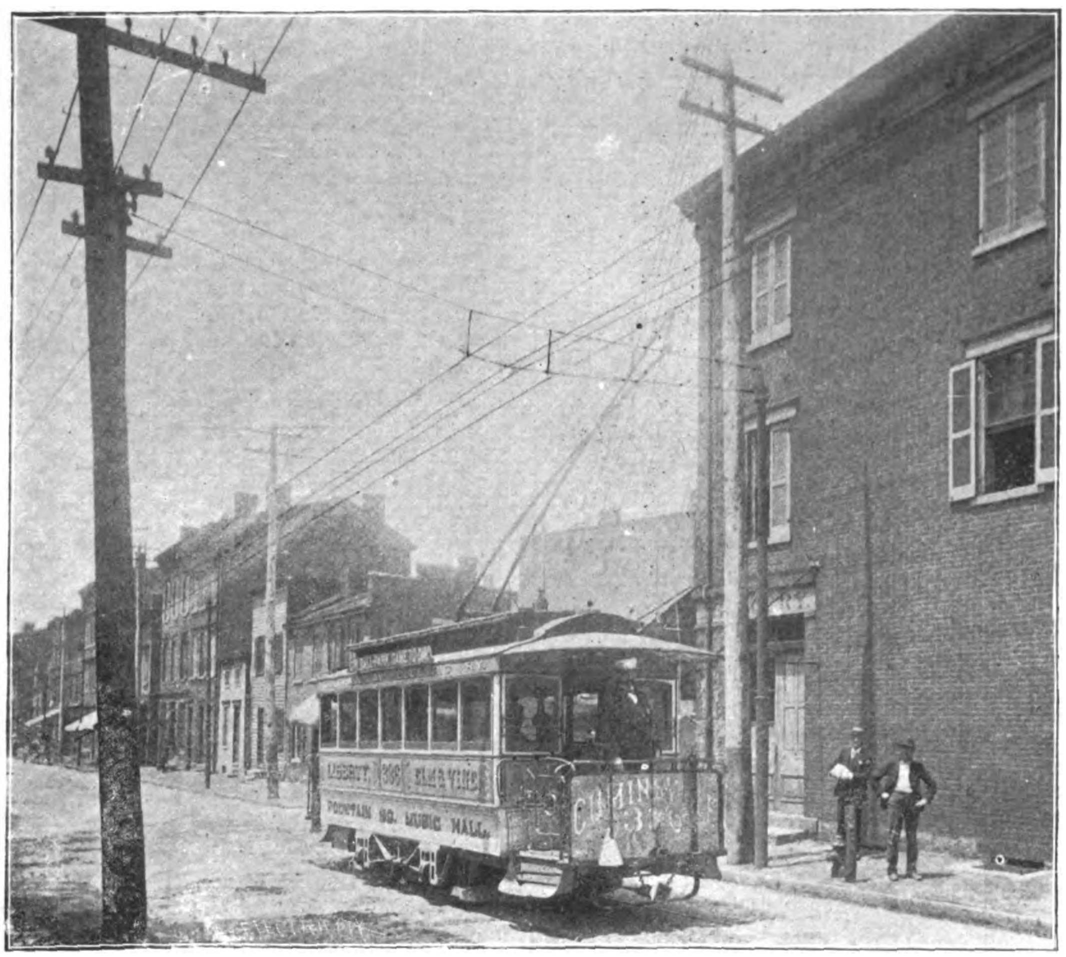
Still another claim was that an extra adhesion to the rail was obtained by passing the current through the wheels, which enabled the single trolley to mount steeper grades than would be possible if the double trolley were employed.

While there are no such grades on any of the double trolley roads in Cincinnati as one short one on the Mt. Auburn line, and experience there does not furnish data to controvert that statement, it is not borne out by theory or by experiments tried elsewhere, and I believe it has now been abndaoned even by its former most strenuous advocates. Certain it is, the adhesion on a double trolley road has been found ample to mount with ease all the grades thus far encountered in Cincinnati.

The steepest grade encountered by the double trolley roads there is on Walnut street, on the route of the Covington and Cincinnati road, viz.: 7.2 per cent. Other important grades are on the Colerain Avenue route 1,000 feet of 4½ per cent. and two others aggregating about 1,600 feet of 3 per cent.

One of the most ludicrous features of this controversy was that those who furnished the equipment of the Colerain Avenue road swore that it was a failure, while the purchasers and users swore equally positively that it was a success in every way—commercially, electrically and mechanically.

In a double trolley road, since there is no ground return, it is necessary, if feeders are employed, as is always the case in Cincinnati, that there be provided a wire return or negative feeder equal in capacity to the positive feeder. This and the extra wire make it somewhat more expensive to build than the single trolley.



TWO DOUBLE CIRCUITS ABOVE THE SAME TRACK.

On account of the multiplication of wires it is more obtrusive, and mechanically more complex, but it is the opinion of many that electrically it is more perfect than the single trolley system. Be that as it may, however, the operators of each system seem to be equally satisfied with what they have, and in Cincinnati it is as useless to argue regarding the relative merits of the double and single trolley systems as it is elsewhere on religion or politics.

The Cincinnati Consolidated Street Ry. Co. have three driving or power stations.

One at Brighton is supplied with thirteen 80,000-watt generators.

One at Pendleton (not completed) will contain nine 80,000-watt generators, and one at the corner of Hunt and McMillan streets contains twenty-four generators of the same size.

Main feeders run from these three stations to reinforce the local or secondary feeders, and the whole system is so tied together that on a pinch, in case any one of the three stations should be disabled, the whole system could be run by the other two.

These three stations operate the Colerain road, containing 6½ miles of single track, over which run 25 motor cars with trailers.

The Walnut Hills and Norwood lines, aggregating 7½ miles of single track, with 13 motor cars and trailers, and the East and West End road, 11½ miles in length, on which will be operated 33 motor cars. This latter route is not yet completed, but soon will be. On this line there is a grade of 8.8 per cent. for about 400 feet.

In addition to the above there is the Covington and Cincinnati road, about 7 miles in length and operating 10 motor cars. These are driven by four 80,000-watt generators located in Covington.

There are, therefore, in Cincinnati 31.5 miles of single track equipped with 81 double trolley motor cars.

The Mt. Auburn single trolley road runs from the center of the city out into the suburbs, and as before mentioned is noteworthy as having been the first electric road constructed in Cincinnati, and also as the successful champion of the single trolley interests against the attacks of the telephonic powers.

As those who are familiar with Cincinnati know, the residence portion is situated upon a plateau some two or three hundred feet above the city proper.

Most of the roads leading to these upper levels are too steep for any form of power traction and difficult even for horses with light loads. Recourse is therefore had to cable roads, of which there are three, and inclined plane railways, of which there are four. These latter contain double tracks upon which run large platforms, which are raised and lowered by cable operated by stationary engines at the top. It is by means of one of these inclined plane railroads that the Mt. Auburn cars are carried to the upper levels. The cars run on to the platform at the bottom and by means of this are taken bodily to the top, where they again make connection with the trolley wire and proceed on their journey.

This particular inclined plane is 860 feet long with a maximum grade of 36 per cent. and a minimum of 25 per cent.

The station at Ludlow Grove, beyond which the road extends 2½ miles, contains two 80,000-watt Edison dynamos, driven by a Brown low speed engine of 250-horse power, and the one on Mt. Auburn contains two 80,000-watt and four 50,000-watt Edison generators, driven by one 250 h.p. Corliss, one 150 h.p. Brown and one 150 h.p. Ball engine. This road extends to Carthage, making a distance of seven miles of double track, or 14 miles of single track. It operates 36 motor cars, which are driven from two stations about 4½ miles apart—one located at Ludlow

Grove and the other at the head of the inclined plane on Mt. Auburn.

It is pre-eminently a road of high grades, the maximum being 13.2 per cent on a 33-foot radius curve. Other important grades are the one between Glenway Avenue and Molitor street, about a mile in length, which varies from 3 to 8½ per cent, and another of about 1,300 feet near St. Bernard, which varies from 4½ to 6 per cent.

It was built in the early days of electric railways, when success was not as sure as now, and was one of the first, if not *the* first, of the Sprague roads that was a signal success from the very start.

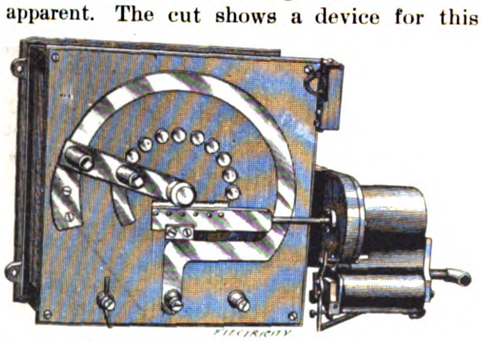
It runs no trail cars, as the length of the inclined plane platform will not permit of it, but its cars are the finest in the city, and a lot of new ones just put on are said to be the finest in the West.

Its patrons are chiefly of the wealthier class who appreciate refinements of this kind, and the present management, who have converted the road from probably the worst managed road in the country into one of the very best, comes in for its full share of appreciation.

CUTTER'S MOTOR STARTING DEVICE.

In operating electric motors it is quite important that resistance should be cut out gradually while the machine is attaining its normal speed, otherwise the armature coils may be burned out. In the case of a stationary motor some arrangement to guard against the sudden cutting out of all resistance is extremely desirable, so that the safety of the motor may be independent of the small boy who may happen to look after it. In the operation of electric elevators, the attendant cannot be expected to move any device slowly, yet the rheostat arm should pass gradually over the segments.

The fact that a motor-starting device is needed is apparent. The cut shows a device for this



Motor Starting Device.

purpose which has just been brought out by George Cutter, of Chicago. It consists of a rheostat with the moving contact bar geared to a piston working in a hydraulic cylinder. A valve controlled by an electro-magnet connects one end of this cylinder with any convenient source of water supply, and the other end with an overflow pipe. The magnet is in shunt with the motor, and as its resistance is high, it takes very little current and can be operated with as small a switch as that used in an ordinary key-socket.

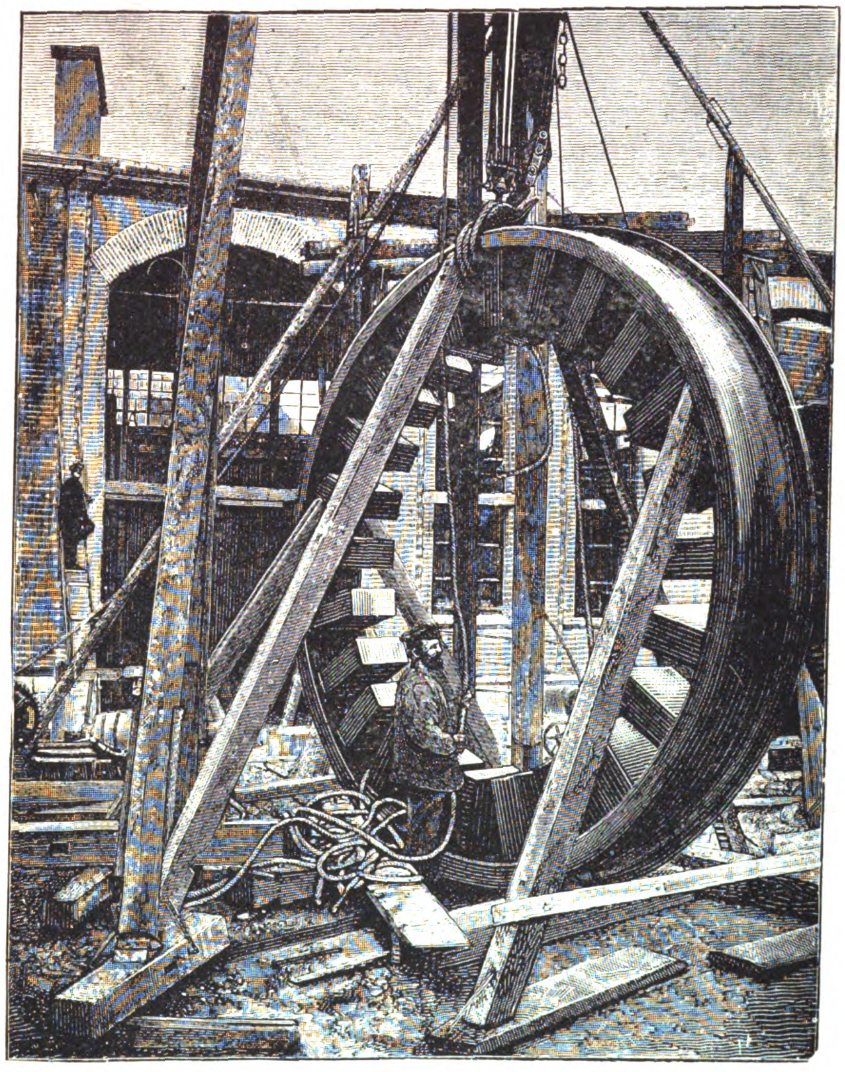
The speed at which the rheostat arm moves will evidently depend on the size of pipe supplying the water to the cylinder, and is easily varied by throttling the pipe. When once set, this device will always turn the current on or off at the same rate As the controlling magnet is in shunt with the motor, the armature will drop when the current ceases to flow and will thus shut off the motor in case of a short circuit on the line. When the current is restored, the device again starts the motor gradually, and thus operates as an automatic safety cut-out.

For elevator service, the controlling switch is placed on the car, and only the small wire of the magnet is run to the car, or a number of such switches may be located at different floors and the elevator operated by any one of them, as may be desirable in the case of a freight elevator or a dumb-waiter. One of these devices is already in constant use at the Berkshire Flats in Chicago.

THE ALUMINUM WORKS AT THE RHINE FALLS.

At the present time the greatest interest is taken in all processes for manufacturing aluminum. The fact that the field of its usefulness will be so broad when it can be sold at a moderate price causes the general public to watch the development of the industry with the keenest interest. At a recent meeting of the American Institute of Electrical Engineers Alexander S. Brown referred incidentally to the reduction plant at Schaffhausen, Germany. Here a magnificent water power, the Rhine Falls, furnishes the energy which operates the plant.

Fifteen hundred horse power are utilized. Three turbines are employed to drive as many dynamos, two of 600 horse power and one of 300 horse power. The dynamos are located directly above the turbines, with their shafts coupled to the shafts of the latter. The gallery containing



Aluminum Works at the Rhine Falls.

the dynamos is enclosed in a glass partition to keep out the dust coming from the furnace. The dynamos were constructed by the Machine Works of Oerlikon. Some idea of their immense size can be gained by the comparison of heights in the cut.

The machines have been in operation for over a year day and night without the least interruption. The statement is made that machines constructed for 6,000 amperes have been worked up to nearly double that amount without suffering any damage.

The two large machines of 600 horse power each are used for the production of aluminum. The smaller machine of 300 horse power is used to excite the field magnets of the former.

The magnet frame of each of the larger machines is a single piece and weighs, without the copper coils, 12 tons. The outer diameter is eleven feet six inches. The armature is of the drum type. The wires do not rest outside on the armature iron, but are placed in openings close to the periphery of the latter. These wires are connected to the commutator by U-shaped copper strips. On the back or upper part similar strips are used, but instead of being connected to the commutator they are fastened together in a very simple way.

This arrangement makes it possible to take out easily any wires in case repairs are necessary without unfastening metal joints, as each wire is kept separate from the others by the iron of the armature.

The armature has 240 wires, which are in connection with a commutator of 120 segments. The diameter of the commutator is about six feet, a dimension necessitated by the enormous quantity of the current. The current is transferred through 24 points to five brushes of which twelve are alternately in connection with a massive copper ring. From the latter the current is supplied directly to the furnaces.

Two of the rings are used for each of the machines. They contain over 6,400 pounds of copper. It was found necessary in casting them to add a little aluminum to the copper, so that they might be perfectly solid.

An ingenious device renders it possible not only to turn the double brush-holding rings round their axes so as to place the brushes properly, but also to remove them as may be required; in addition each brush is provided with a simple apparatus to adjust it to take up the wear.

The axes of the machines are vertical, the armature shaft being set over, and, as already stated, coupled directly to the turbines. The advantage

lies, in the first place, in the increased facility afforded for handling the commutators and 120 brushes on each machine. Another advantage is, that the copper dust from the commutator and brushes falls directly underneath, and not into the magnet frame and armature, which would be the case with a horizontal position.

The two larger machines are constructed to develop 14,000 amperes at 30 volts, or 420,000 watts, with uninterrupted working day and night; but this estimate is rather low, as the power may be increased on special occasions to 500,000 watts.

The number of revolutions is 200 a minute, but 150 are sufficient to give the full current specified. These machines were at the time they were constructed, it is claimed, the largest direct current dynamos in the world. What has been said with regard to the construction and adjustment of the larger machines bears reference equally to the smaller dynamo of 300 horse power, its magnet frame having an outer diameter of 98.4 inches and weighing 21,000 pounds without the copper wrapping; it has eight poles. The armature with a diameter 47 inches has 160 wires, which are in connection with 80 collecting segments.

Corresponding to the number of poles there are eight sets of brushes. The performance of this dynamo at 300 revolutions reaches 3,000 amperes at 65 volts, or 195,000 watts, which, for similar reasons to those stated above, may be increased to 250,000 watts.

REPAIRS FOR PATENTED MACHINES.

The question recently arose in England on the right of a person to supply parts of a patented machine in order to repair it. The case is stated thus:

A is the owner of a patent machine patented as a combination.

A sells one of these machines to B.

B requires parts of the machine to repair breakages, and orders them from C, a third person not connected with the patentee, A.

A serves C with notice that he must not supply the parts required for repairs.

Query.—Is C legally entitled to supply the parts to B, the parts being portions of a machine protected by the combination patent in question.

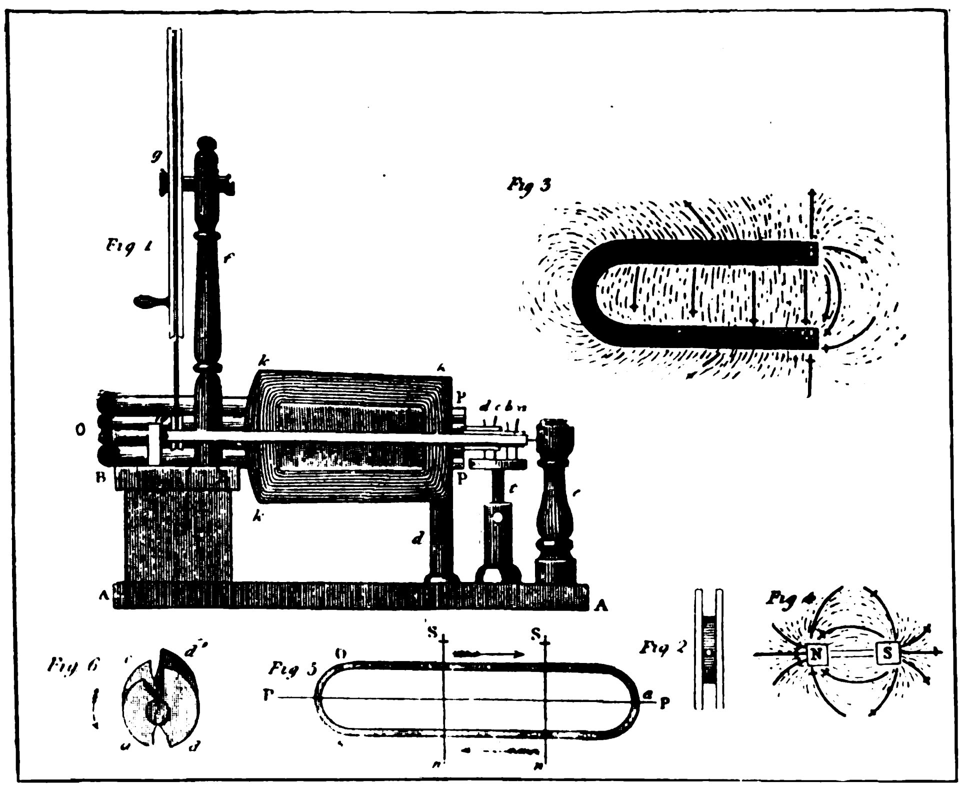
A patent attorney furnishes ELECTRICITY the following opinion in regard to the United States law: "So long as the identity of the machine is retained the owner has the right to replace the broken or worn-out parts, and C is legally entitled to supply them." This case is cited: Gottfried *v.* Seipp Brewing Co., 10 Biss., 368.

AN EARLY DYNAMO.

It is the custom in this day of patent litigation, when all other means of testing the validity of a patent have failed, to examine the scientific researches of pioneers in the field. This is especially true in cases relating to electrical inventions. In this connection it is interesting to note the description of a dynamo built by William Sturgeon and described by him several years after in a paper read before the Royal Society, June 16, 1836.

Referring to the cuts, which are reproduced from *Engineering*, Fig. 1 shows half of the horseshoe magnet removed, and a cross-section of the armature. Fig. 2 is an end view of the core of the armature, and shows the hole for the armature shaft. The magnet used was a four-bar horseshoe, weighing 23 pounds.

In referring to Fig. 1, Sturgeon gave the following description:



AN EARLY DYNAMO.

"The spindle *i i* passes through the pillar *f* (which supports the wheel *g*), and also through the axis of the reel *k k k k* to which it is fixed. On the reel is coiled 200 ft. of copper wire, about 1-20 in. in diameter, and covered with stout white sewing silk, to prevent metallic contact in the coil. The reel which holds the wire is made of two thin pieces of deal, of the shape *k k k k*, which form the cheeks, and are kept about 1¼ in. apart and parallel to each other by the pieces which cross them for the reception of the wire. The extremities of the wire terminate in a discharging arrangement to be described in the sequel. When the magnet is placed on the stage, its plane is parallel to the plane of the base board. The spindle *i i*, which is also parallel to the axis of the base board, is situated in the axis of the magnet. By this arrangement the coil is made to revolve between the branches of the magnet, and electric currents are excited whilst the coil travels through the magnetic lines." Sturgeon now refers to Fig. 5 as representing the wire circuit, and Fig. 3 as representing the magnetic field, and at some length traces out the phases of current production, much in the same words as may be met with in a textbook of the present day. He then describes a number of experiments with the machine, and afterwards he alludes to a machine with a horseshoe armature and also the one-direction commutator. The structure of the one-direction commutator will be sufficiently obvious from the sketches, small hollows containing mercury fulfilling the functions of the ordinary brushes, and as these obviously have to be horizontal, the commutator must be made double, as shown by Fig. 6, segments *c* and *d* being connected with one end of the wire, while segments *a* and d^1 are connected with the other end.

The results obtained from this machine by Sturgeon are very interesting. He stated in his paper that he could liberate one cubic inch of gas from acidulated water in eight minutes. He also pointed out the superiority of his dynamo over voltaic batteries for electro-plating purposes.

ELECTRICAL CURRENT TOPICS.

A correspondent writing from Springfield, O., describes with rare gusto the operation of the first electric line in that city. He makes this remark: "I even heard the other day of a bridal couple who were too poor to go anywhere on a tour, and who finally compromised on a bridal tour on the electric cars."

* * *

A Cincinnati paper devotes a half column to paragraphs making brief mention of "Our Men of Affairs." In the list are mentioned several electrical men; among the number are John Kilgour, of the Cincinnati Street Railway Company; Captain George M. Stone, and Henry Hanna, of the Cincinnati Telephone Company, and Harold Ryland, of the Cincinnati Electric Light Company.

* * *

The papers have been full of cable dispatches descriptive of the presentation of Wagner operas at Bayreuth. It is interesting to note that the scenic effects are reported to be exceptionally brilliant, and the cable states that this achievement is due to the effective, judicious and liberal use of incandescent lights. It is probably true that the prettiest effects ever produced on the stage by electric lights have been seen in Wagner's operas.

* * *

An important decision was handed down in Cincinnati a few days ago, which is of interest to those who own electric light or gas fixtures. Judge Wallace decided that the gas fixtures in the Grand Hotel, which cost $25,000, belonged to the realty. It is stated that the rule of law as to gas fixtures is that, they belong to the realty only when it was the manifest intention of the builder to so regard them. In the reported cases they have generally been classed as personalty.

* * *

There has been for years, in many cities, a demand that electrical companies remove their wires from the streets. For many reasons it was impossible to comply generally with this demand. Lately companies in several cities have reached the point where they find themselves able to bury a considerable proportion of their wires. Strange to say, their request for permission to do so has been refused in at least two or three instances. Why the franchises have been refused it is hard to imagine. Certainly electrical companies have not so conducted themselves that all their requests should be regarded as unreasonable.

* * *

There is an advertiser in Boston, whose card is to be seen in electrical journals, who has adopted a novel scheme to determine the relative merits of the technical papers as advertising mediums. His office is located at the end of a street and consequently bears the highest number on the thoroughfare. The number, it will be assumed, is 200. In the first advertisement he orders he inserts the proper address; in the second he substitutes 202, the third 204, and so on as high as he desires. He makes a note of each case in a book which he keeps for the purpose. When a letter addressed to "202" reaches him he credits the paper in which the advertisement containing this number appeared. At the end of the year he looks over his book, and finding the number of credits given he has the data before him to determine the papers in which his card shall be published for the next period. He thinks he has found a great system. As his office is located at the end of the street, persons who wish to call on him experience no difficulty in finding him.

Several Chicago builders are now using aluminum in the construction of office buildings. It is used for ornamental purposes. In two blocks the bright metal is employed for elevator guards, railings, newel posts, etc. A few Chicago establishments have used aluminum for ornamental door plates, but it is believed that in no buildings in the country has the metal been employed so extensively as in two office structures now building. In all probability the metal will enter even more largely into the construction of magnificent buildings as the refinement of electrical reduction processes makes its cost even less than it is to-day.

* * *

Six years ago there were no storage battery boats on the River Thames. At the Henley regatta, July 7, there were sixteen. A correspondent of ELECTRICITY in London sends this word: "One of these electric boats, named after the Countess of Albermarle, is the largest and most luxurious of her class in existence. The motion of these electric launches is smoothness itself."

* * *

A valued contributor of ELECTRICITY sends this bit of information: In 1815 Mary Brush was granted a patent upon a stay. This, perhaps, may be regarded as furnishing proof that inventive genius runs in families. It may be added that more recent Brush patents seem to be of the "staying" sort.

* * *

A Cleveland motor man enunciated an important rule of action when he said: "I don't never have no accidents, coz I don't never take no risks." The superfluous negatives cancel out.

ELECTRIC HEATING.

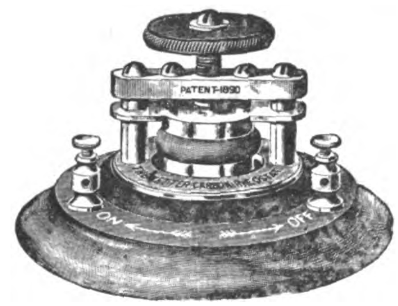
Within the last few months, the question of heating by electricity has attracted a marked degree of attention. One of the largest railway companies in the country proposes to try the plan of heating its limited train by electricity, and if the scheme is successful--and there is no reason why it should not be- the example will naturally be followed by competing roads. The heaters will be installed as an attractive novelty, which all railway companies are anxious to secure for their fancy trains; but if the utility of the heaters is demonstrated, they will be generally adopted for more important reasons. Presumably all railroads in the country would be glad to discard the "deadly car stove" if they could find a satisfactory substitute.

Street car companies which used electric heaters last winter have almost without an exception found them successful, and not uneconomical. As to the cost of operation, it is stated that it is not much more than that of the coal which is used in the car stoves. The latter are dirty, and as a rule are extremely unreliable, but at the same time very faithful in the production of noxious gases, and distribution of ashes. Many a time in cold weather in Chicago the interior of the cars on the South Side is exceedingly uncomfortable on account of foul air.

But there is a demand for heaters even in houses. In several places in the West, and in Canada, where electric generators are operated by water power, and where current is cheap, there is talk of installing heaters on quite a general scale. Even in Chicago a capitalist is considering the idea of putting electric heaters in an appartment building which he proposes to construct. There are many cases, he says, in which people want heat for just a short time, but who object to the use of gas or oil stoves. The temperature may not be low enough to warrant starting the furnace or boiler. If the electric heater were installed, and heat could be obtained by turning a switch, the problem would, he thinks, be very prettily solved.

NEW RHEOSTAT FOR MEDICAL BATTERIES.

A circuit controller of ingenious design has been patented by J. C. Vetter & Co., New York. The principle adopted in the construction of this rheostat is the effect of variation in resistance which takes place in carbon with a change in pressure. A quantity of specially prepared carbon in a finely divided state is placed in a small rubber pouch or cylinder, which is enclosed by two metal plates to which the two sides of the circuit are connected. The lower plate is fixed to the base of the instrument, and the other, traveling in upright guides, can be depressed by means of a screw with a very fine thread, so as to compress the carbon in the rubber cylinder. In this way the current passing can be adjusted with the



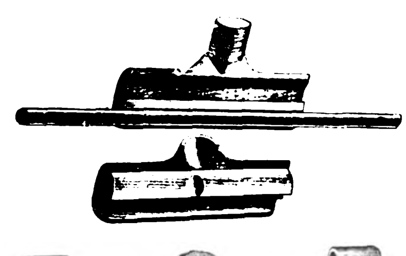
RHEOSTAT FOR MEDICAL BATTERIES.

greatest nicety, as the variation in the resistance of the rheostat follows the movement of the screw through very wide limits.

The instrument is compact, and well finished. The delicacy of adjustment is a feature which is emphasized. The application of a rheostat of this description to incandescent lighting, it is claimed, would meet the objection made by many to the electric light, that it must be either at full candle power or turned off entirely. By means of an easily adjustable rheostat, the light of an incandescent lamp could be regulated even more easily than that of a gas jet. Another useful application of this rheostat would be for the regulation of small motors, especially fan motors, which could be made to run at any desired speed.

CHICAGO TROLLEY CLAMP.

The trolley wire clamp, illustrated in the cuts, was devised by John S. Gustin, purchasing agent of the Electric Merchandise Company, Chicago.

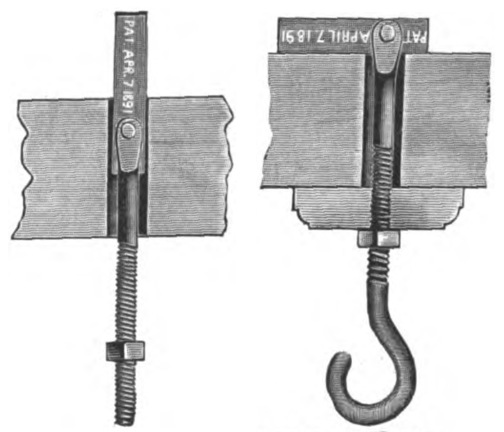


TROLLEY CLAMP.

The clamp is composed of three distinct parts, two sections forming the opposing lips, one of which is provided with a threaded projection on which the clamping nut, the third part, is screwed, and the other provided with a dog enclosed by the protruding rim of the nut. Through the lower portion of these opposing sections a groove is formed to contain the trolley wire, the size of which does not call for a different construction of the clamp. The opposing lips are cut at such an angle that they still engage each other when the largest trolley wire is inserted in the groove. Screwing down the nut upon the threaded projection and over the dog causes the lips to slide one within the other, thus forcing together the lower sections of the clamp upon the wire, and preventing all tendency to fall. The movement of the wire from expansion and contraction is provided for in the hinge joint included in the nut. The simple mechanism of the clamp makes its adjustment, at any place upon the wire, or its removal, an easy task. The clamp is equally efficient whatever may be the style of insulator used. While possessing all necessary strength, the clamp is light and presents a neat appearance.

ELECTROLIER HOOK.

It frequently happens that it is impossible to hang electroliers or chandeliers in the center of a room because there is no joist at that point into which to screw the hook. This is especially true in most modern buildings where tiling is used so extensively. To avoid this difficulty, Thomas Wrigley, of Chicago, has patented the device shown in the illustrations. Fig. 1 represents a toggle bolt, upon the lower end of which is turned a



FIGS. 1 AND 2 ELECTROLIER HOOK.

hook. To place the hook in position a hole is bored in the tiling or ceiling and the toggle is pushed through, Fig. 2. As it passes through the hole the weight of the long end of the toggle throws it down at a right angle to the bolt. A small circular block of wood is then pressed against the ceiling by a nut on the shank of the hook. The toggle bolts are also made with eyes instead of hooks, and can be used in connection with a pipe clamp for supporting water or gas pipes. The bolts are manufactured out of steel, and have been found, upon actual test, capable of supporting over three hundred pounds.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The officials of the Department of Electricity were interested in the suggestion, made by a contributor in last week's issue of ELECTRICITY, that power from Niagara Falls should be transmitted electrically to Chicago, to be utilized at the World's Fair. "The suggestion is all right," said one of the number. "Now, if ELECTRICITY will provide the necessary money, or show us a copper mine, which we can tap, the scheme might be carried out."

James W. Queen & Co., of Philadelphia, makers of scientific instruments, have made an application for space, and will make an extensive exhibit.

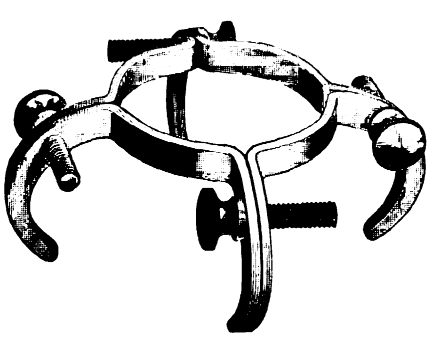
A number of young men interested in organizing a national amateur electrical society met in the rooms of the Department of Electricity last Thursday evening. The object of the meeting was to discuss the advisability of forming a so-

ciety for the mutual benefit of young electricians, and arrange for a display at the World's Fair. Secretary Hornsby, of the electrical department of the Columbian Exposition, was present and spoke very approvingly of the formation of such an organization. He stated that if the young men would organize themselves with the object of displaying their work at the World's Fair, in his next monthly report to the committee on electricity he would advise that a separate department be formed and that prizes be offered for the best models exhibited. O. E. Cozzen was elected temporary chairman, and committees were appointed on permanent organization and constitution. The next meeting will be held to-morrow evening, in room 506 Rand-McNally building. All amateur electricians are invited to attend this meeting. Secretary Hornsby will be present to aid in perfecting a permanent organization.

A French company has written to the authorities of the Fair asking that it be given an opportunity to make a brilliant electrical display at the opening ceremonies in October, '92. It proposes by a judicious use of electric lights, presumably incandescent lamps, to represent historic scenes, etc. The company writes that it will need 2,800 horse power to effect the brilliant result.

SHADE HOLDER.

The aim of most electrical fixture men has been to invent a universal shade holder, and there have



Shade Holder.

been devised a number of such appliances. The holder shown in the cut is adjustable over a considerable range of sizes. It is claimed that it will fit all sockets from a Brush-Swan to an Edison. It can be placed in position without the use of a screw driver. The shade holder is handled by the Electrical Supply Co., Chicago.

A NEW TROLLEY WIRE SPLICER.

One of the many street railway devices recently invented by M. M. Wood, of Chicago, is a trolley wire splicer, illustrated in Figs. 1 and 2. The device, it is claimed, will do away with the vexatious trouble of soldering the old style of coupling. In

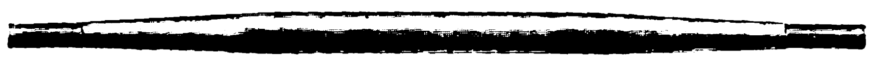


Fig. 1.

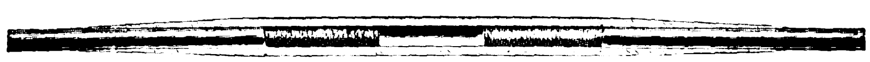


Fig. 2.

Trolley Wire Splicer.

applying the clamp to a break in the trolley wire, a right hand thread is turned on one end of the broken wire and a left hand thread on the other. The ends of the wire are placed in the sides of the coupling, which is then screwed up to the required position. Fig. 1 shows the splicer as used on the line. Fig. 2 is a cross section showing the right and left hand threads near the middle of the coupling. The splicer can be used without solder, and therefore can readily be taken off and the trolley wire removed, in case a building is moved across the track. The device is placed on the market by the Electrical Supply Company, Chicago.

WHAT IS SAID OF "ELECTRICITY."

Before Electricity had been published six hours a letter reached this office with a request that a contemporary be allowed to use matter contained in the issue. The articles in the first number have already suggested topics for editorials in several of the large dailies. The following are extracts selected from a few of the press notices:

Chicago Post.

The new periodical promises to take rank among the best publications of its class.

Rochester Herald.

The first number is handsomely illustrated, beautifully printed, and, for an initial appearance, remarkably well supplied with advertisements. Electricity will have an editor and business manager in its New York office and an office also in Boston. We tender the new paper our congratulations and best wishes.

Standard, Chicago.

That the new paper will make its mark is not to be doubted. * * * Uniting the two features in the way proposed, this new paper will doubtless have a place and currency quite its own.

Interior, Chicago.

It is a bright, readable, well printed and well illustrated journal, its initial number impressing the reader with the varied character of its contents, which are popular and practical, as well as technical.

Chicago Globe.

The paper is beautifully printed, and its reading matter embraces all the numerous matters which come under the head of electricity and its application.

Evening Wisconsin.

The first number has, besides a large amount of reading on electrical subjects, a number of well-executed illustrations, including a representation of the operation of an electric search light on shipboard

Rochester Union Advertiser.

The intention of the promoters of this new trade-paper is to make it first in its field, and that they will succeed no one who knows them doubts. The introductory editorial states that the new paper will be "popular and practical, as well as technical and theoretical." If this policy is carried out Electricity should find many readers among those interested in electrical work, but not versed in its intricacies.

Chicago Inter-Ocean.

In the first place it is a model of typography, and then it really seems to have a long felt want to fill, in that it aims to cover its field in a popular and practical way as well as technically.

Rochester Post Express.

Rochester people will be especially interested in the venture.

Chicago Herald.

It is neatly printed, attractively illustrated and the class of matter with which it is filled is at once high and readable.

Chicago Morning News.

The first number is handsomely got up and contains several interesting articles.

Rochester Sunday Herald.

It is bright, interesting, carefully edited, and made attractive by handsome illustrations. One part of it is devoted to the technicalities of the subject, and under this department valuable information relative to the giant strides of electricity for purposes of light and power is given in the first and will be continued in the successive issues. The feature which distinguishes Electricity from other electric journals, however, is a department treating of everyday application and growing importance of this mysterious force in plain language, with as complete an elimination of technical terms as possible, the intention being to give information that any one may understand and that will interest everybody.

TELEGRAPH WIRES IN NICARAGUA.

A correspondent at Rivas, Nicaragua, writes as follows in regard to the telegraph line which has been constructed by Nicaragua canal engineers:

It was found necessary to establish telegraphic communications with the various parties at work along the line, and for this purpose a telegraph line was put up. Some idea of what this involved may be had from the facts that new poles have to be provided every six months, and that the undergrowth has to be cut from under the wires every four months. A superintendent, three foremen, and seventeen men are always busy keeping the pathway of this line clear. The truth is, the undergrowth of Nicaragua is composed in great part of weeds that assume the dimensions and some other characteristics of trees. They have huge bodies and leaves of marvelously quick growth, but the wood is soft and easily cut when green. The telegraph route is cleared about four rods wide.

FROM NEWS CENTERS.

NEW YORK CITY.

New York, July 25. It has for some time been known that District Attorney Nicoll was preparing an indictment against one of the New York daily papers for the violation of section 507 of criminal proceedings, and the distinction of being chosen as a victim seems rather to have been sought after than avoided. Mr. Nicoll has, at last, decided on his line of attack, and the grand jury has indicted Charles O'C. Henessy, city editor of the New York *Daily News*, on the charge of misdemeanor for publishing an account of the recent electrocutions at Sing Sing. A demurrer will probably be entered, and if denied the *Daily News* will plead guilty and carry the case to the Court of Appeals. The purpose of the indictment is to test the validity of the law with a view to repealing that section which relates to publishing accounts of executions.

The immediate outcome of the recent decision in favor of the Edison Electric Light Company, in the incandescent lamp suit against the United States Electric Lighting Company, was the issuance on Wednesday last of an indictment restraining the United States Company from doing any new business in the manufacture of the incandescent lamp, in which it was held that the Edison patent had been infringed, but the company is allowed to carry on its business already on hand. It was represented to Judge Wallace that there were thousands of lamps in use on which the Edison patent could not be used, and it would be a great hardship if the contracts already made could not be carried out. It was also suggested that in case the Edison works should burn down, the incandescent lamp business of the whole country would be at a standstill. The appeal from Judge Wallace's decision will be argued before the Circuit Court of Appeals in the fall. On Thursday counsel for the Edison Company and the United States Company appeared before Judge Wallace, sitting in chambers of the United States Circuit Court, to decide on the amount of the bond which the latter company was directed to give to protect the Edison Company if the judgment obtained by that company should be sustained by the appellate court. It was agreed that $50,000 would be an equitable sum, and the United States Company was allowed ten days in which to execute a bond for that amount. Judge Wallace then signed the stay of the writ of injunction, pending the result of the appeal to the higher court, on the ground that it would be unfair to the United States Company, after it had been conducting business for five years without interruption, to stay its business at this time.

Capt. Henry F. Picking, of the Light House Board, has given notice that three electric light buoys on the starboard side of Gedney's Channel, in the Lower Bay, have become temporarily extinguished, and repairs have been ordered. Notwithstanding the fact that the extinction of the Gedney Channel lamps has been somewhat frequent, it is beyond question that as a means of indicating the channel at night this service is invaluable to the mariner. The main defect seems to have developed in the small cables leading from the junction boxes to the buoys. The armor of the smaller cables is found to be too light for the service. They are subject to more severe usage than the main or triple conductor cables, since in raising and changing the buoys and making connections, that part of the cable between the buoy and the junction box is liable to heavy strain, besides exposure to injury from anchors, dredges, etc. In spite of these drawbacks, at no time have there been less than three lamps in operation, a sufficient number to render the passage of the largest vessel through the channel at night safe and practicable.

A further stage has been reached in the decision of the rapid transit plans, and the route for the East Side has been declared by the Commission. An underground four-track road will diverge from the proposed Broadway line at or near Fourteenth street, and run thence under Union Square and Fourth and Park avenues to near and south of Forty-second street; thence by a suitable curve to the westward, under such private property and streets as shall be found practicable, to Madison avenue at or near Forty-fourth street; thence under Madison avenue to a point at or near Ninety-sixth street; thence curving to the eastward to a point not less than 100 feet east of Madison avenue, to a point near and south of One Hundred and Thirty-fourth street; thence by a curve to the eastward, and by a bridge across the Harlem River. The general plan of construction from Broadway to a point near Ninety-sixth street will be either by a double-decked tunnel, with two tracks on each deck, or four tracks upon

the same level, as may be found upon further examination and survey to be most expeditious, and as near the surface as shall be found practicable; from near Ninety-sixth street north a viaduct with four tracks will extend to the Harlem River. The conditions as to locations of stations and all incidental appliances will be substantially the same as those required for the proposed West Side line decided on by the Board in May. The New York public, which in some matters is patient and long-suffering to a fault, seems to think it should receive this promise of good things to come with some show of gratitude, but at the same time it cannot repress a growing uneasiness as to whether a question, involving issues which can be decided only by engineers of skill and experience, has advisedly been left for deliberation and final decision to a lay commission appointed by the mayor of the city, and whether, after all this delay, it may not have to accept the shadow instead of the reality of rapid transit, a system possessing some points of merit, but in reality falling far short of the complete embodiment of the most advanced and scientific methods of the age, which New York has a right to expect.

Judge Coxe, of the United States Circuit Court, has decided that the Brush Electric Company is entitled to the control in this country of the manufacture and sale of electric storage batteries. The press of New York is almost unanimous in the expression of satisfaction at the prospect of the immediate resumption of the storage battery service on Fourth and Madison avenues. It will be remembered that the Julien company, when it imported its system from Belgium, was sued for infringement by the Electrical Accumulator and the Brush companies, and the last corporation also brought an action against the first named. The first suit heard was that between the Electrical Accumulator and the Julien companies, and it resulted in a decision whereby the former was awarded a narrow claim, sufficient to enjoin the rival company from running its cars. The effect of this decision was temporarily evaded by a new process of manufacture, and storage battery traction was resumed on the Fourth and Madison avenue line. Immediately after this the cause of the Brush company against the Julien company came on for hearing, and a decision was rendered whereby the defendants were enjoined from the use of the storage battery in any form. Following this the Consolidated Electric Storage Company, successors to the Julien Company, purchased the exclusive rights throughout the United States for the Brush storage battery patents, and the cause of the Brush against the Electrical Accumulator company came to a hearing about a month ago. The case will in all probability go to appeal, but in the meantime the public will enjoy the rapid and convenient service which had become so popular before its discontinuance.

The North River was the scene on Thursday night of a brilliant exhibition of the search light in naval drill. Several gunboats took their stations in the river, and took part in the drill, which was specially designed to instruct the naval reserve in the manner of guarding against an attack by an enemy's torpedo boat. The air was filled with flashes and pillars of light from the search lights of the gunboats, and every object that was illuminated became as plainly visible as in daylight. A part of the drill consisted of a thorough course of signaling by electric light, and all of the arrangements were well carried out. It was clearly demonstrated that an advancing torpedo would have a poor chance of coming near any of the ships, but it was impossible on the other hand to avoid arriving at the conclusion that the search light made each ship operating it a splendid target for the enemy's guns.

G. H. G.

BOSTON.

BOSTON, July 25.—The New England Telephone and Telegraph Company has declared a dividend of 75 cents per share, payable August 15 to stockholders of record July 31.

The Quincy, Mass., Electric Light and Power Company has just declared a dividend of 6 per cent, payable on August 1. This company illuminates the city of Quincy, and also supplies power to the Quincy & Boston and the Manet Beach electric railways.

The National Association of Fire Engineers will hold its annual convention at Springfield, Mass., on August 11, 12, 13 and 14. This is to be a most important convention, and during its sessions elaborate and interesting experiments with the electric current as an auxiliary to fire departments will be conducted at the city hall.

Business is not prospering on the storage battery street railway between Beverly and Danvers, Mass., largely owing to differences between the stockholders and lessees. Everyone interested in electric railway matters in this district is anxiously waiting to see what the outcome will be.

Lightning damaged the armature of a dynamo in the Middlesboro, Mass., Gas and Electric Company's plant a few nights ago.

The long and lively controversy over the electric lighting question at Wakefield, Mass., may yet terminate in the selectmen adopting the new municipal lighting law, and either purchase the existing plant or erect a new one.

Preliminary to taking action, the electric light committee, recently appointed by the citizens of Melrose, Mass., is distributing circulars containing questions, among householders and others, which, when answered and returned, will enable the committee to move intelligently in the direction of establishing a municipal plant in that town.

The constant increase of business has at last compelled the Western Union Telegraph Company to build a line between Concord and Portsmouth, N. H., which has just been completed.

The American Optical Company, whose optical goods are known everywhere, is having erected a central electric plant for lighting and power purposes in its works at Lensdale, Southridge, Mass. The plant will be an extensive one and will be operated by two large Hunt turbine wheels.

Within about three months it is expected that the traveling public, when necessary, will be able to ride from the extreme south side of Boston to Salem by electric cars, as the Lynn & Boston Street Railway is to be connected with the electric system of the West End Company, which company will furnish the power. The journey will then be nearly thirty miles long.

Suit has been entered against the East Side Electric Street Railway Company, Brockton, Mass., and also against the Old Colony R. R. Co. by a Mrs. Dawson, for injuries received in a collision between a passenger train and an electric street car at a grade crossing. Damages are laid by Mrs. Dawson, who claims to have been lamed for life, at \$40,000, while her husband is suing also for \$20,000 for loss of his wife's services. Should this suit be successful, others will follow by parties who received injuries at the same time.

A director of the Thomson-Houston Electric Company declares that his company is more than satisfied with the decision in the Edison incandescent light lawsuit, as his company owns a large number of patents which are thereby rendered valuable.

The stockholders of the Southern New England Telephone Company have just received a quarterly dividend of one per cent.

The Edison General Electric Company is to furnish the town of Waterville, Me., with an electric light plant at a cost of \$11,000, and work on the construction will commence at once.

An electric light commission from Wheeling, W. Va., has this week visited Worcester, Providence and Lynn, to examine into the working of the Thomson-Houston system. The city of Wheeling has appropriated \$100,000 for the construction of a municipal plant.

The Lynn & Boston Railway Company is said to have placed an order with the Westinghouse Electric Company for three generators of 125-h.p. capacity. Also forty-five motors of 20-h.p. capacity each. These motors are of the noiseless, gearless type.

W. G. K.

PITTSBURG, PA.

PITTSBURG, July 25.—Another step towards the removal of the overhead wires in large cities took place yesterday by the organization of the Pittsburg Underground Electric Construction Company, to equip electric and cable street railways with the underground system, under patents granted to John J. Miller, of this city. The gentlemen composing this organization are cautious, and conservative, and it is evident that the project is a good one.

The officers and directors elected were: C. D. Robbins, a successful oil producer of Washington County, as president; D. J. Rex, manufacturer of this city, secretary and treasurer. C. F. Shoemaker, superintendent of the Liggett Spring and Axle Company; F. A. Mann, nut and bolt manufacturer, of Cleveland, O.; F. J. Osterling, architect, and John J. Miller, of the Robbins Electric Company, the inventor of the system, comprise the directory.

The company is organized with a capital stock of \$300,000, of which \$96,000 was paid in yesterday.

It is said that Philadelphia, Washington and New York people have investigated the patents of Mr. Miller, and have invited him to visit their respective places, with a view of constructing and equipping a trial plant. The inventions consist of a complete system of street railway appliances, motors, underground trolley, rail and roadbed.

E.

INCORPORATIONS.

The following new companies have been incorporated:

Merchants' Electric Light Co., Leavenworth, Kan., capital stock, \$50,000; promoters, J. H. E. Wiegant, W. B. Walker, E. Michael, Leavenworth, Kan.

The Light, Heat and Power Company, New Albany, Ind.; capital stock, \$50,000; to operate an electric light station; incorporators, Marcus Ruthenburg, John S. Briggs, Otto Hoffman.

The Cutter Electrical & Manufacturing Co., Camden, N. J., capital stock, \$100,000; to manufacture electrical and mechanical devices; promoters, H. B. Cutter, E. Cobbe, E. M. Dobelbower, all of Philadelphia, Pa.

The Artelectro Company, Cleveland, O. (incorporated in West Virginia), capital stock, \$1,000,000; to manufacture electrical devices of all kinds; promotors, N. S. Amstuz, Geo. Hoyt, C. W. Foote, all of Cleveland, O.

The United States Bulletin Company, (incorporated in W. Va.) of New York, N. Y.; capital stock, \$200,000; to manufacture and sell electrical appliances for reporting events; promoters, M. D. Compton, Newark, N. J.; J. N. White, Tottenville, N. Y.; A. H. White, Red Bank, N. J.; O. S. Woodruff, Newark, N. J.; J. Fred Glasby, Elizabeth, N. J.

Fairmont Development Company, Fairmont, W. Va.; capital stock, \$800,000; single share, \$100; business to be prosecuted: establishing a town for manufacturing, mining and dealing in lumber, coal, iron, brick and oil; constructing electric, gas, and water plants, and operating same; promoters, O. S. McKinney, C. L. Smith, C. W. Amett, J. E. Watson, S. L. Watson, all of Fairmont, W. Va.

POWER.

The work of constructing the electric railway at Meadville, Pa., was begun last week.

The Short Electric Company, of Cleveland, O., will equip the electric railway at Wilkesbarre, Pa.

The Patton motor car has been exhibited at Pullman to a large number of persons during the last two weeks. The combination which comprises Mr. Patton's system is located in an ordinary car. The central part of the car is enclosed, and here are located a gas engine and dynamo. Under the seats are placed a sufficient number of storage batteries. The motor is located directly on the axle. Ordinarily the current from the dynamo is used in driving the motor, but in going down grades, or on level stretches, the car needs little power. In these cases the excess of current charges the batteries, which are called upon for power in ascending grades and in rounding curves. The inventor claims that his combination proves extremely economical in practice.

The news comes from Detroit that the whole system of the Detroit street railways, over eighty miles in length, has been purchased by Waller, Cook & Wagner, lawyers, of 15 Wall street, representatives of a New York and Boston syndicate, for about \$5,000,000. S. Harrison Wagner, of the firm named, said that this information is accurate except that the consideration is something more than \$5,000,000. Mr. Wagner added: "My partners, ex-Gov. Waller and Mr. Cook, are now in Detroit completing the arrangements for the transfer. The deal was practically consummated last week. I am not at liberty to give the names of the gentlemen who are in the buying party. The change of ownership will take effect at once, and the new owners will change the motive power on all the lines to electricity, which will throw some 2,300 horses on the market."

The Chicago-Evanston Electric Railway Company, with a capital stock of \$500,000, has just been incorporated by J. L. Cochran, D. A. Louderback, Alexander Clark and Frank S. Gorton. These gentlemen will at once undertake to secure the necessary frontage and also get the franchise from the four municipalities through which the line will run, Evanston, South Evanston, Rogers Park and Chicago. The bulk of the right of way in the township of Evanston has been secured, and as soon as the required amount for the entire line has been signed and a franchise granted, the Edison Electric Company agrees, through John J. Beggs, its district manager, to construct and operate the line. The road is to be a double track, overhead system. The cost of the road is estimated at \$500,000. The projectors will endeavor to effect an arrangement with the North Side Railway Company whereby trailers from this line can be hooked to trains, and the passage between Evanston and the city made without change; but should this prove unsuccessful, it is asserted they will extend their line into the city on the surface as far as it is possible, after which they will reach the heart of the city by means of elevated tracks, the claim being made that there is sufficient capital behind the enterprise to accomplish this.

LIGHT.

Proposals for furnishing an electric light plant for the Southern Illinois Penitentiary, at Chester, will be received until August 11.

Frank J. Meehan will build an electric light station at Washburn, Wis. He has secured a contract for lighting the place with arc lamps.

Business men at Bessemer, Col., intend to organize an electric light company. It is stated that the subscriptions to the stock are now sufficient to warrant the purchase of a plant.

The electric light companies of Des Moines, Ia., have suffered greatly of late from wire thieves. Recently a young man was arrested for the offense, and one hundred pounds of wire was recovered.

The Thomson-Houston Electric Company has secured the contract for furnishing two arc dynamos for the new Herald building in Chicago. A circle of six lights will be arranged above the building. The wires will be concealed in the building, and interior conduits will be used.

The Hyde Park Electric Light & Power Company, Chicago, has increased its capital stock from $100,000 to $500,000. This action is the result of the intention of the company to enlarge its field of operations. The company is now conducting the business of arc lighting with about 300 lights in operation, and with lighting plants at 4112 Drexel boulevard for the Oakland district, at the Hyde Park hotel, at Hyde Park, for that locality, and at the Drop Forge Works at Kensington, whereby that place and Roseland are supplied with electric light. It has recently erected at considerable expense a superb plant at Grand Crossing, with which connection will be made within a week. These four circuits will then be supplied from that point and connection with the other plants cut off. The Drexel boulevard plant, consisting of four dynamos and a 150-horse power engine, will be retained, as there is a strong possibility that the company will begin to furnish incandescent light or go into the house lighting branch of the business in the Oakland district within a year. The new plant at Grand Crossing is at present of about 300-horse power, but has been constructed with a view to its enlargement as it may become necessary. It will eventually be increased to 1,000-horse power. The business of the company is growing rapidly. Its franchise includes seventeen villages, some of which, as will be seen, it is already supplying with light, and extensions will be made to the others at an early date, South Chicago, Hegewisch, Colehour and Pullman all being fields for the immediate future. The company has recently received a proposition from the department of public works to light the boulevards south, and also from the World's Fair for 200 lights for the site, that work may be continued day and night uninterruptedly. John R. Bensley is president of the company, D. P. Perry, vice-president, G. A. Rollins, secretary, and S. P. Parmly treasurer. W. H. Rand, C. T. Trego and S. A. Maxwell are also heavily interested.

PERSONAL NOTES.

S. G. Booker, manager of the Fidelity Carbon Company, of St. Louis, was in Chicago for several days last week.

Carl Kammeyer, of the National Electric Manufacturing Company, of Eau Claire, was in Chicago for a short time last week.

Everson Wilson has left New York for Leeds, England, where he will install an electric railway for the Thomson-Houston Company.

George P. Barton, of Barton & Brown, Chicago, patent attorneys, has left for Portland, Ore., and will be absent on a vacation for several weeks.

W. W. Griscom, of the Electro Dynamic Company, Philadelphia, was in Chicago last week. Mr. Griscom has just returned from inspecting the storage battery road in Dubuque, which is operating, he says, in a most satisfactory manner. He was not willing to be quoted in regard to the recent accumulator decision.

COMMERCIAL PARAGRAPHS.

W. R. Mason, of the Electric Merchandise Company, Chicago, says he is fairly overwhelmed with inquiries in regard to the Burton electric heater.

The Economic Electric Co., of Boston and Brockton, reports itself way behind the orders for its specialties, the incandescent lamps manufactured by this company becoming very much in demand.

F. E. Pettingell, president of the prosperous Pettingell-Andrews Co., has quite recovered from his recent illness and has begun to hustle once more in his usual bright and business-like manner.

Messrs. Claflin & Kimball, Boston representatives for the Mather Electric Co.'s dynamos and motors, also for Perkins incandescent lamps, are enjoying a brisk demand for their goods and keep quite busy shipping goods and installing plants.

The demand for the efficient McIntosh-Seymour engines continues to increase, and the J. A. Grant Co., of Boston, that handles these engines, is enjoying a "run of luck" with them. They have won an enviable record throughout the electrical field.

The Electric Merchandise Company, of Chicago, is putting on the market the Chicago trolley wire clamp, which combines many features of excellence. It is the invention of John S. Gustin, of the company, who has produced a device which it will be difficult to improve.

Messrs. F. M. Kimball & Co., electrical engineers, of Merrimac street, Boston, continue doing a large business with South America, as well as with all parts of this country. The demand for their efficient dynamos, motors and high grade instruments of precision is constantly on the increase.

Messrs. Pinkham & Godfrey, electrical engineers, 38 Bradford street, Boston, though quite a young firm, are winning rapid success. Among other important contracts on their books is one for wiring throughout the handsome new Columbian theatre now building on the corner of Washington and Massachusetts streets, the electrical equipment for which is to be of the completest and most efficient kind.

C. J. Becker, formerly foreman for the Belding Motor Co., and his brother, O. E. Becker, have started a general job and repair shop in commodious quarters at 39 West Washington street, Chicago. They have purchased the very latest improved machinery and intend to make a specialty of repairing motors, dynamos and lamps. They have engaged several of the best armature winders from the different electrical companies, so as to be able to turn out first class work in rewinding armatures.

Speaking of the Northwest Thomson-Houston Electric Company, of 403 and 405 Sibley St., St. Paul, the St. Paul *Globe* says: "At the present time the officers of this company are H. M. Byllesby, president; H. C. Levis, vice-president and treasurer; B. F. Meek, Jr., secretary and assistant treasurer, and George C. Duffie, assistant secretary. Its board of directors comprises some of the most prominent men in St. Paul. Messrs. Byllesby and Levis, of this company, have recently made St. Paul their home, both of these gentlemen having been previously residents of Pittsburg, Pa., and where they were engaged as officers of the Westinghouse Electric & Manufacturing Company. These gentlemen have had a broad experience in the electrical business, and are widely known among the electrical interests. B. F. Meek, Jr., the secretary and assistant treasurer, is well known in St. Paul, having been here for upward of ten years, and having been identified with some prominent industries of this city. Mr. Duffie has been identified with the company for a long while, and is likewise well known in this city."

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 13, 1891.

ELECTRIC RAILWAYS.

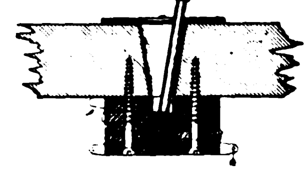
455796. Electric Railway. R. M. Hunter, Philadelphia, Penn. Application filed May 22, 1886.
Claim one is:
"I. In the herein described system of telpherage, the combination of a conductor divided into sections, switches which normally bridge from one section to the other, traveling trains or vehicles, one or more electric motors on the trains or vehicles by which they are driven, and devices operated by the trains or vehicles to move said switches successively and divert the current through the motors on said trains or vehicles, so that the motors are connected in series through the divided conductor."

455798. Trolley for Electric Cars. Walter H. Knight, Newton, Mass. Application filed April 8, 1891.

455956. Electric Railway System. Samuel P. Wilcox, Elkhart, Ind., and Joseph D. Partello, Rochester, Mich. Application filed June 16, 1890.
This invention relates to conduit electric railways with electric cables under ground, the electric current being conveyed to the motor on the car through a contact trolley traveling on a sectional track suspended within the conduit.

DYNAMOS AND MOTORS.

455765. Electric Motor. H. H. Porter, New York, N. Y. Application filed January 17, 1891.



PATENT NO. 455,747—LOOP SWITCH.

455790. Dynamo Electric Machine or Motor. J. B. Entz, New York, N. Y. Application filed Nov. 24, 1890.

455856. Holder for Carbon Brushes of Commutators. Clarence H. Farrington, Milford, Mass. Application filed Oct. 21, 1890.

455887. Armature for Dynamo Electric Machines. Edwin W. Rice, jr., Lynn, Mass. Application filed March 21, 1891.
This invention is simply an improvement in the means of holding the armature in place.

455898. Electric Motor or Dynamo Electric Machine. Charles G. Curtis, New York, N. Y. Application filed March 9, 1891.
The principal object of this invention is to provide a practically water proof motor for street car service.

455971. Armature for Dynamos. Frederick L. McGahan, Indianapolis, Ind. Application filed Dec. 26, 1890.

MINING.

455808. Electro-Magnetic Ore Separator. Jonas Wenstrom, Orebro, Sweden. Application filed Dec. 24, 1890.

455809. Magnetic Separator. Jonas Wenstrom, Orebro, Sweden. Application filed Dec. 24, 1890.

455984. Magnetic Separator. Henry G. Fisk, New York, N. Y. Application filed March 26, 1891.
Claim one is:
"A magnetic separator provided with a centrifugal acting feeding device for feeding the mixed mass of magnetic and non-magnetic particles across the field on the under side of the magnets."

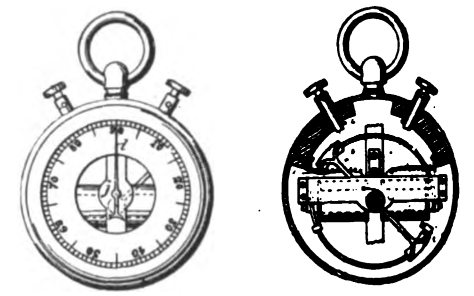
455985. Magnetic Ore Separator. Henry G. Fisk, New York, N. Y. Application filed March 26, 1891.

CABLES.

455789. Process of Manufacturing Insulated Conductors. Charles Cuttriss, New York, N. Y. Application filed Aug. 6, 1890.
Claim one is:
"The improvement in the art of insulating electric conductors, which consists in applying to or winding on a conductor the loose fibres of a material such as cotton and compacting the same to form a felted or matted sheathing."

455904. Insulated Electrical Conductor. Edwin D. McCracken, Alpine, N. J. Application filed March 5, 1891.
Claim one is:
"An electrical conductor having wound thereon a paper tape composed of twisted paper or paper cord flattened."

456120. Insulated Electric Conductors. Edwin D. McCracken, Alpine, N. J. Application filed March 4, 1891.
The claim is:
"The combination of the conductor, the insulating cords arranged parallel, or substantially so, and in contact therewith, but separated from each other, and exterior insulating material that holds the cords in place."



PATENT NO. 455,855—INDICATOR.

BATTERIES.

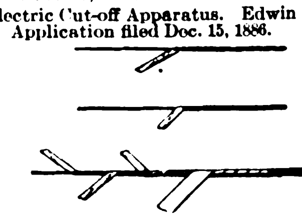
455968. Secondary Battery Plate. John R. MacLaughlan, Philadelphia, Penn. Application filed June 3, 1890.
The claim is:
"A secondary battery plate composed of opposite end bars and transverse connecting bars, all of aluminium, said connecting bars being of hollow trough-like form with inturned edges and adapted for the reception of the active material."

MISCELLANEOUS.

455747. Loop Switch. W. M. Goodridge, Highland Park, Ill. Application filed March 4, 1887.
The invention relates to electrical switches for looping in and out alternately different instruments, and is specially designed for use as a part of the key board apparatus of a telephone exchange.

455788. Thermostat. H. A. Chase, Boston, Mass. Application filed Oct. 29, 1888.

455800. Electric Cut-off Apparatus. Edwin W. Rice, Lynn, Mass. Application filed Dec. 15, 1886.



PATENT NO. 455,904—INSULATED CONDUCTOR.

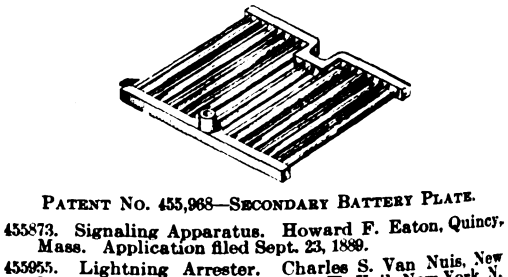
455812. Fire Alarm Apparatus. Henry A. Chase, Stoneham, Mass., and Howard F. Eaton, Cambridge, Mass. Application filed July 28, 1887.
This invention has for its object to construct a suitable receiving apparatus in a fire alarm system whereby false alarms will be detected at once without causing the true fire alarm to respond.

455813. Thermostat. Henry A. Chase, Boston, Mass., and Howard F. Eaton, Cambridge, Mass. Application filed Nov. 1, 1888.
This thermostat is designed for use in a closed circuit and is adapted to operate as many times as required.

455815. Electro Phonometer and Phonoscope. Isaiah H. Farnham, Wellesley, Mass. Application filed Feb. 13, 1891.
An instrument for observing and measuring the disturbing effect of foreign currents on telephone lines.

455837. Electric Switch. Carl G. Dahlgren and John H. Svensson, Guthenburg, Sweden. Application filed Dec. 24, 1890.

455855. Electric Indicator. Earl C. Eldredge, Springfield, Mass. Application filed Feb. 9, 1891.
The object of this invention is to provide a convenient, simple and effective indicator which may be used in any position to indicate instantly the strength of an electric current.



PATENT NO. 455,968—SECONDARY BATTERY PLATE.

455873. Signaling Apparatus. Howard F. Eaton, Quincy, Mass. Application filed Sept. 23, 1889.

455955. Lightning Arrester. Charles S. Van Nuis, New Brunswick, N. J., and Jonathan H. Vail, New York, N. Y. Application filed Oct. 16, 1890.

455981. Apparatus for Administering Electricity. George H. Bethel, Sidney, New South Wales. Application filed Oct. 13, 1890.

456006. Street or Station Indicator. William D. Snedden, San Francisco, Cal. Application filed Jan. 14, 1891.

456021. Electric Belt. Lewis N. Fancher, Kansas City, Mo. Application filed April 6, 1891.

ELECTRICITY.

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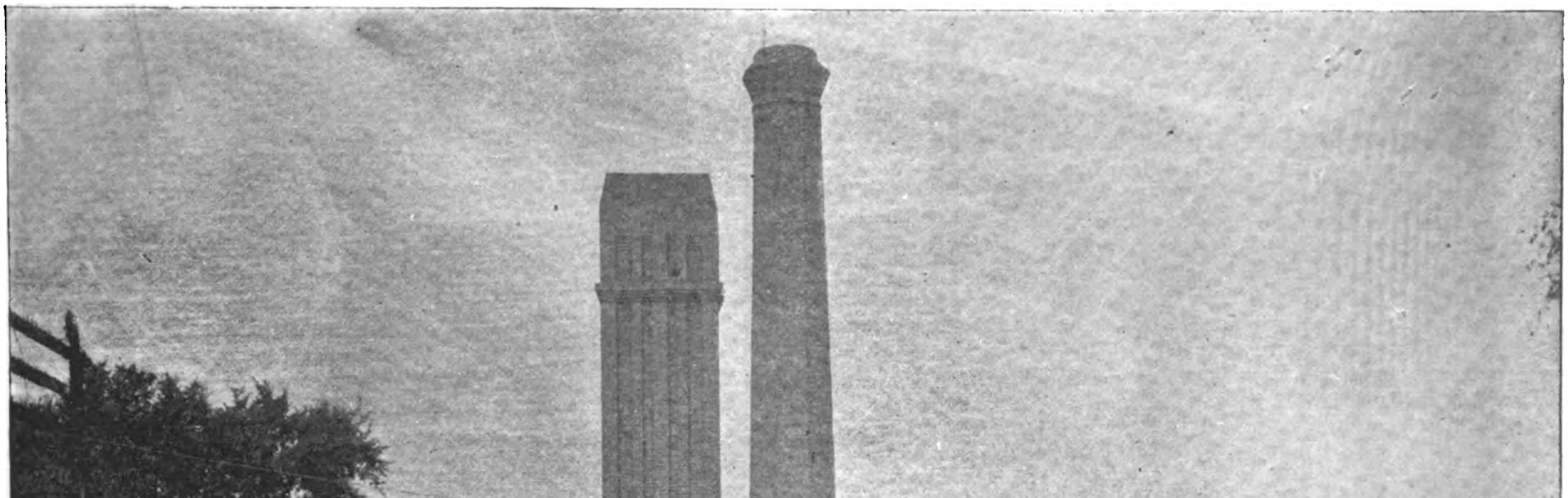

RUINS OF THE ELECTRIC LIGHT STATION AT ST. GEORGE, STATEN ISLAND.

(*See page 42.*)

ELECTRICITY AND THE SURGEON.

BY M. D.

In the days when the country doctor carried his lancets and his pills in his saddle bags, or jogged over country roads in a more comfortable fashion, we hear of one sawbones, more brilliant than his fellows, who cleared the rear of his vehicle of small boys by fastening to it two knobs just convenient to swing from. In fact, the knobs were the terminals of the secondary circuit of an induction coil. The physician never heard the cry "on behind" as he drove through the village streets. Not less effective are the more recent surgical appliances which depend upon electricity. Some of these possess more than a professional interest.

If we look about a modern hospital operating-theatre to see the part played by electricity, we notice first of all the electric light. It is not a necessity, to be sure, but one of those luxuries that come to be almost necessities. Especially do we realize that the fact holds good in this case when we notice the ease with which a hand electric lamp can be held in any position in order to give the operator the best view of the field; when we realize the freedom from all danger of explosion, an accident which has been known to occur when ether has been given in the presence of an ordinary light.

But there are more delicate purposes to which the incandescent lamp can be applied, where no substitute would be possible, and so the surgeon is now enabled to perform operations guided by his eye, where before he had only the sense of touch to guide him—perhaps not even that. Thus in exploring the natural cavities of the body, as in removing a tumor of the wall of the bladder, one has only to introduce through the wound a small lamp upon a convenient handle to gain the most accurate knowledge of what is going on, and an operation, which without electricity would be wholly in the dark, with this light in the hands of a dextrous surgeon becomes as simple as if the operation were performed on the surface of the body. The appliance is illustrated diagramatically in Fig. 1.

More wonderful still, the cavities of the body may be explored through their natural channels by means of a long tube fitted with lenses and mirrors and carrying its own light. Thus the bladder and even the stomach may be thoroughly looked over for diseased spots. It has long been known to jugglers that by tipping the head well back the route from the mouth to the stomach becomes practically a straight line—so nearly so

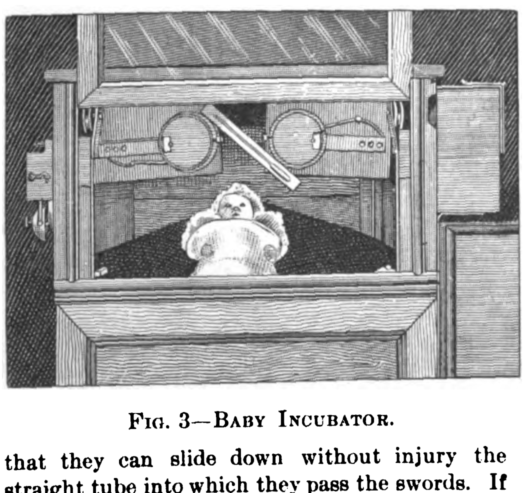

Fig. 3—Baby Incubator.

that they can slide down without injury the straight tube into which they pass the swords. If instead of passing the tube and sword we introduce such an instrument as is shown in the diagram, Fig. 2, we are enabled, if the stomach has been first washed and filled with clear water to distend its walls, to look it all over and see if it has any abnormal portion. Such an operation sounds almost ridiculous, but it is none the less practicable and comparatively a trivial undertaking for the patient—not the sort of thing to be done every morning before breakfast as an appetiser, but still not half as uncomfortable as crossing the ocean, for instance.

So much for the light. As a regulator of all kinds of exact scientific machinery electricity is known to every one. If the physician wishes to make an exact record of the heart beats he asks electricity to record for him the exact time when he began and finished, and perhaps to dot along on the moving strip of paper the individual seconds for his convenience. It is therefore with little surprise that one reads of an electrical apparatus to regulate the heat in an incubator designed for the purpose of bringing up children prematurely born. This ingenious device is worth more than passing notice.

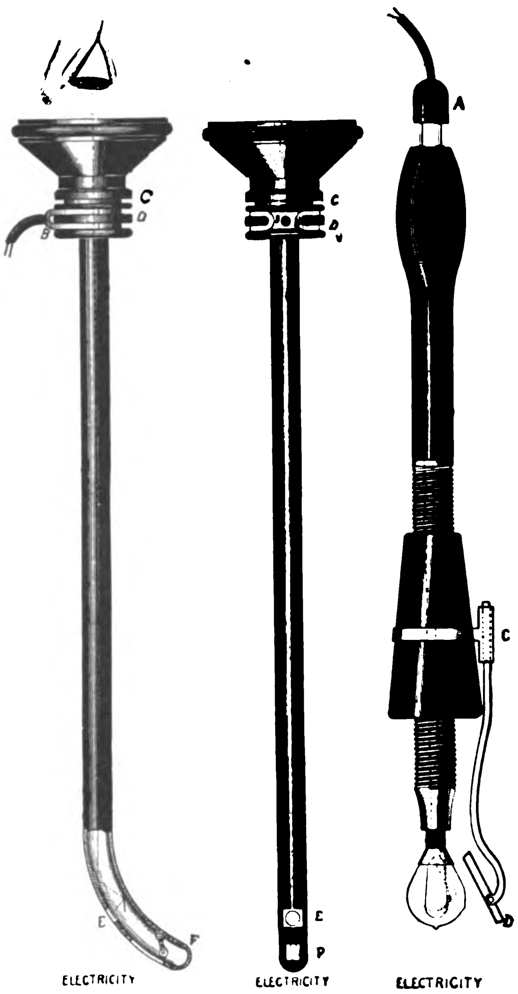

Fig. 1. Fig. 2. Fig. 3.

Electric Light Appliances for Surgeons.

It is well known that children born a month or six weeks before the time nature intended them for out-of-door life can live if they are left quietly by the kitchen fire and carefully fed and looked after. Several weeks earlier their digestive organs are well enough formed to assimilate sufficient nourishment to sustain life, but it is at once seen that so undeveloped a nature must have the most favorable chance imaginable in order to pull through, and that means that he shall be kept at an absolutely fixed temperature and be moved no oftener than is necessary to give him food and care.

Incubators have been devised similar to those in which eggs are hatched to accomplish these ends; but the apparatus to regulate the heat was not automatic, or, if so, was not delicate enough to do away with a nurse's constant care, and the best nurse may sleep. In the apparatus illustrated in the cut, Fig. 3, a thermometer makes or breaks the circuit leading to the heating regulator and so turns up or down the gas or oil flame which heats the incubator. The general arrangement of the electro-magnetic regulator is shown in Fig. 4. In the illustration an oil heater is shown at the right. So delicate is the mechanism that it is easy to maintain the temperature constantly within one-half a degree of the point desired. But not content with this safeguard, in the Maternity Hospital where these machines are in use, the inventor has arranged a second circuit so that if the temperature should vary beyond the prescribed limit a bell would ring in the nurse's room and an indicator will announce which little waif is suffering from one degree too much heat or cold.

CHICAGO ELECTRIC CLUB DINNER.

The members of the Chicago Electric Club enjoyed an informal dinner at the club rooms last Thursday evening. Although the organization has maintained its own restaurant service for several months, this was the first time members sat down as a body at their own tables. The evening was an extremely enjoyable one. The supper was excellent and at its conclusion the members were entertained by off-hand speeches. Mr. Degenhardt assumed the position of master of ceremonies. E. E. Keller, of the Electrical Department of the World's Fair, said, while not a great deal had been accomplished in his section yet, he was hopeful that the department would soon be in a flourishing condition. Mr. Hitt spoke of the difficulties attendant upon the electro deposition of copper. He said while there was silver in the copper ore the company in which he was interested found it necessary before obtaining it to put in considerable gold. Experiments to extract the gold were now in progress. Mr. McDougall spoke of the desirability of extending the use of the electric motor in Chicago. Other speakers were: Messrs. Kempt, Ferguson, Wissig, Childs, Reynolds, Pumpelly, Pearson, Carter and Nate. A resolution was passed thanking W. B. Pearson for his efforts in arranging for the dinner, which was so successful that similar meetings will probably be held periodically.

AMBULANCE TELEPHONE SERVICE IN PARIS.

The telephone service, the essential part of the new city ambulance system in Paris, is now thoroughly organized. The plan was conceived by Dr. Nachtel who had noticed that great delays often occurred in providing assistance to those that met with accidents in the streets. The ambulance station is located at the Hospital of St. Louis, where a special pavilion has been provided. Here two physicians, and a telephone operator are always on duty. A special telephone system connects the pavilion with the police station and drug stores in the area in which it is proposed to respond to calls. The district covers the central portion of the city where accidents are most likely to occur; the area is a circle with a diameter of about six miles. When a call comes in, the

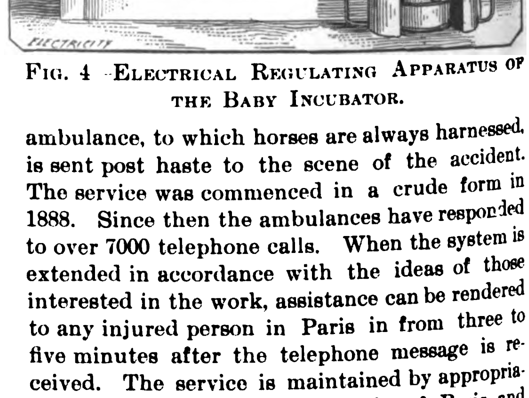

Fig. 4—Electrical Regulating Apparatus of the Baby Incubator.

ambulance, to which horses are always harnessed, is sent post haste to the scene of the accident. The service was commenced in a crude form in 1888. Since then the ambulances have responded to over 7000 telephone calls. When the system is extended in accordance with the ideas of those interested in the work, assistance can be rendered to any injured person in Paris in from three to five minutes after the telephone message is received. The service is maintained by appropriations from the government, the city of Paris, and by private subscriptions.

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Communications relating to subjects within the province of this journal are cordially invited. News notes, descriptions of new devices with drawings or photographs, are at all times desired.

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A WRITER in another column speaks of the increasing popularity of the electric light in England, and reviews the interesting paper of W. H. Preece with its striking endorsement of the electric light as an economical illuminant.

* * *

THE electric railway service between Minneapolis and St. Paul is now in operation, and is giving entire satisfaction according to the reports. The system, which is briefly described elsewhere, might be adopted to advantage in many places.

* * *

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ELECTRICITY AND THE SURGEON.

BY M. D.

In the days when the country doctor carried his lancets and his pills in his saddle bags, or jogged over country roads in a more comfortable fashion, we hear of one sawbones, more brilliant than his fellows, who cleared the rear of his vehicle of small boys by fastening to it two knobs just convenient to swing from. In fact, the knobs were the terminals of the secondary circuit of an induction coil. The physician never heard the cry "on behind" as he drove through the village streets. Not less effective are the more recent surgical appliances which depend upon electricity. Some of these possess more than a professional interest.

If we look about a modern hospital operating-theatre to see the part played by electricity, we notice first of all the electric light. It is not a necessity, to be sure, but one of those luxuries that come to be almost necessities. Especially do we realize that the fact holds good in this case when we notice the ease with which a hand electric lamp can be held in any position in order to give the operator the best view of the field; when we realize the freedom from all danger of explosion, an accident which has been known to occur when ether has been given in the presence of an ordinary light.

But there are more delicate purposes to which the incandescent lamp can be applied, where no substitute would be possible, and so the surgeon is now enabled to perform operations guided by his eye, where before he had only the sense of touch to guide him—perhaps not even that. Thus in exploring the natural cavities of the body, as in removing a tumor of the wall of the bladder, one has only to introduce through the wound a small lamp upon a convenient handle to gain the most accurate knowledge of what is going on, and an operation, which without electricity would be wholly in the dark, with this light in the hands of a dextrous surgeon becomes as simple as if the operation were performed on the surface of the body. The appliance is illustrated diagramatically in Fig. 1.

More wonderful still, the cavities of the body may be explored through their natural channels by means of a long tube fitted with lenses and mirrors and carrying its own light. Thus the bladder and even the stomach may be thoroughly looked over for diseased spots. It has long been known to jugglers that by tipping the head well back the route from the mouth to the stomach becomes practically a straight line—so nearly so

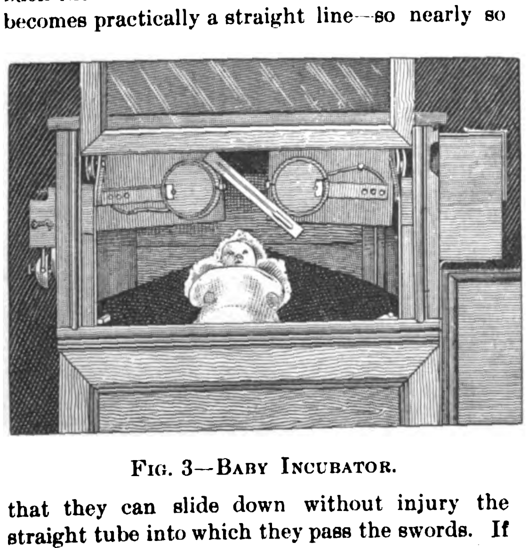

Fig. 3—Baby Incubator.

that they can slide down without injury the straight tube into which they pass the swords. If instead of passing the tube and sword we introduce such an instrument as is shown in the diagram, Fig. 2, we are enabled, if the stomach has been first washed and filled with clear water to distend its walls, to look it all over and see if it has any abnormal portion. Such an operation sounds almost ridiculous, but it is none the less practicable and comparatively a trivial undertaking for the patient—not the sort of thing to be done every morning before breakfast as an appetiser, but still not half as uncomfortable as crossing the ocean, for instance.

So much for the light. As a regulator of all kinds of exact scientific machinery electricity is known to every one. If the physician wishes to make an exact record of the heart beats he asks electricity to record for him the exact time when he began and finished, and perhaps to dot along on the moving strip of paper the individual seconds for his con-

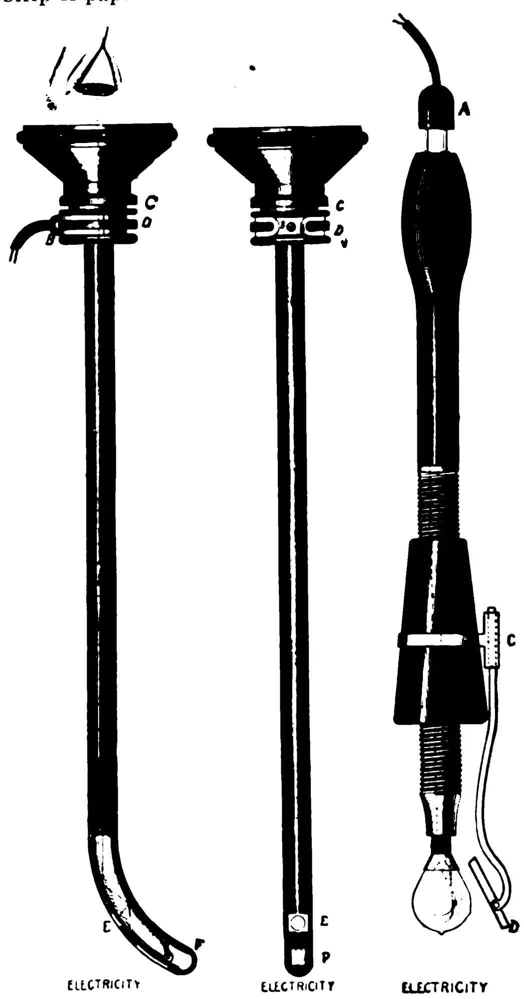

Fig. 1. Fig. 2. Fig. 3.

Electric Light Appliances for Surgeons.

venience. It is therefore with little surprise that one reads of an electrical apparatus to regulate the heat in an incubator designed for the purpose of bringing up children prematurely born. This ingenious device is worth more than passing notice.

It is well known that children born a month or six weeks before the time nature intended them for out-of-door life can live if they are left quietly by the kitchen fire and carefully fed and looked after. Several weeks earlier their digestive organs are well enough formed to assimilate sufficient nourishment to sustain life, but it is at once seen that so undeveloped a nature must have the most favorable chance imaginable in order to pull through, and that means that he shall be kept at an absolutely fixed temperature and be moved no oftener than is necessary to give him food and care.

Incubators have been devised similar to those in which eggs are hatched to accomplish these ends; but the apparatus to regulate the heat was not automatic, or, if so, was not delicate enough to do away with a nurse's constant care, and the best nurse may sleep. In the apparatus illustrated in the cut, Fig. 3, a thermometer makes or breaks the circuit leading to the heating regulator and so turns up or down the gas or oil flame which heats the incubator. The general arrangement of the electro-magnetic regulator is shown in Fig. 4. In the illustration an oil heater is shown at the right. So delicate is the mechanism that it is easy to maintain the temperature constantly within one-half a degree of the point desired. But not content with this safeguard, in the Maternity Hospital where these machines are in use, the inventor has arranged a second circuit so that if the temperature should vary beyond the prescribed limit a bell would ring in the nurse's room and an indicator will announce which little waif is suffering from one degree too much heat or cold.

CHICAGO ELECTRIC CLUB DINNER.

The members of the Chicago Electric Club enjoyed an informal dinner at the club rooms last Thursday evening. Although the organization has maintained its own restaurant service for several months, this was the first time members sat down as a body at their own tables. The evening was an extremely enjoyable one. The supper was excellent and at its conclusion the members were entertained by off-hand speeches. Mr. Degenhardt assumed the position of master of ceremonies. E. E. Keller, of the Electrical Department of the World's Fair, said, while not a great deal had been accomplished in his section yet, he was hopeful that the department would soon be in a flourishing condition. Mr. Hitt spoke of the difficulties attendant upon the electro deposition of copper. He said while there was silver in the copper ore the company in which he was interested found it necessary before obtaining it to put in considerable gold. Experiments to extract the gold were now in progress. Mr. McDougall spoke of the desirability of extending the use of the electric motor in Chicago. Other speakers were: Messrs. Kempt, Ferguson, Wissig, Childs, Reynolds, Pumpelly, Pearson, Carter and Nate. A resolution was passed thanking W. B. Pearson for his efforts in arranging for the dinner, which was so successful that similar meetings will probably be held periodically.

AMBULANCE TELEPHONE SERVICE IN PARIS.

The telephone service, the essential part of the new city ambulance system in Paris, is now thoroughly organized. The plan was conceived by Dr. Nachtel who had noticed that great delays often occurred in providing assistance to those that met with accidents in the streets. The ambulance station is located at the Hospital of St. Louis, where a special pavilion has been provided. Here two physicians, and a telephone operator are always on duty. A special telephone system connects the pavilion with the police station and drug stores in the area in which it is proposed to respond to calls. The district covers the central portion of the city where accidents are most likely to occur; the area is a circle with a diameter of about six miles. When a call comes in, the

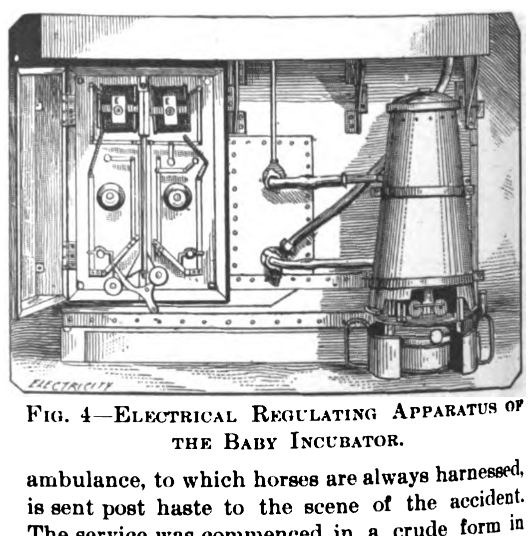

Fig. 4—Electrical Regulating Apparatus of the Baby Incubator.

ambulance, to which horses are always harnessed, is sent post haste to the scene of the accident. The service was commenced in a crude form in 1888. Since then the ambulances have responded to over 7000 telephone calls. When the system is extended in accordance with the ideas of those interested in the work, assistance can be rendered to any injured person in Paris in from three to five minutes after the telephone message is received. The service is maintained by appropriations from the government, the city of Paris, and by private subscriptions.

ELECTRICITY

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A WRITER in another column speaks of the increasing popularity of the electric light in England, and reviews the interesting paper of W. H. Preece with its striking endorsement of the electric light as an economical illuminant.

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LESSON OF THE STATEN ISLAND ELECTRIC LIGHT STATION FIRE.

BY M. C. SULLIVAN.

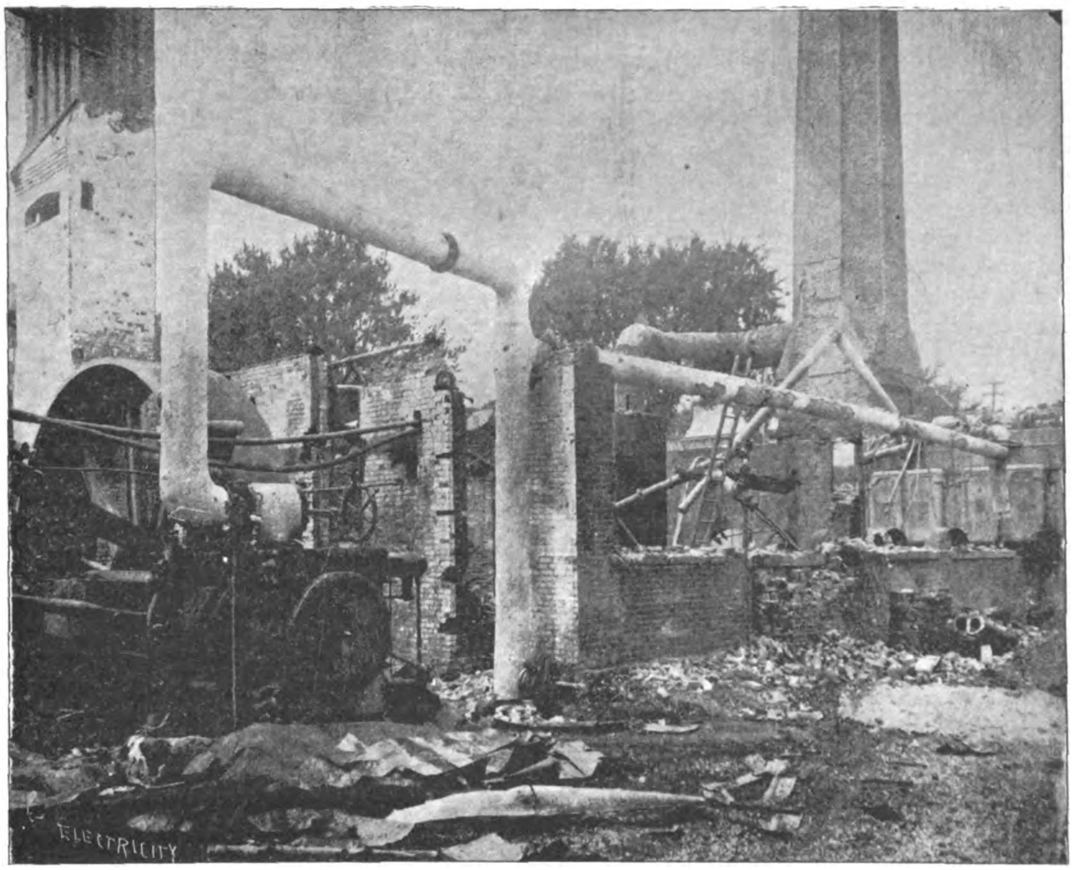
Since the inauguration of the central station industry, many things have been learned as to construction and operation. Indeed, the day seems not far distant when electric lighting from central stations will be carried out on as perfect a system as that which characterizes the use of the great rival of the electric light -gas.

Up to the present, however, a most important consideration seems to have been lost sight of, namely, the adaptability of buildings for this purpose. It is true that in many cases existing conditions, rather than of negligence, have been responsible for this. Thus, what are now some of the most prominent stations had their beginning in the shape of a single dynamo or two, placed "wherever there was room," or, perhaps, in some building that could not be used for other purposes.

As time demonstrated the great field of usefulness which the electric current developed, people became convinced that they no longer had a mere experiment to deal with, but a great business. New apparatus was installed to meet the demands of an appreciative public, but little or no attention was paid to the safeguards against fire necessary to insure the continued confidence of electric light followers.

It may be said without hesitation that of all the central station people at present supplying current, few consider how seriously they would be affected by the outbreak of a fire in their station. In fact, there seems to be on this subject an almost fatuous disregard of even ordinary conditions and precautions. No provision is made for auxiliary equipment for fireproof walls to confine the fire when once started or for effective means to combat it in its incipiency. It is a grave consideration that in a single hour many fine stations which, from both an electrical and an engineering standpoint, are regarded with pride by their management, may be reduced in one short hour to ashes, as was the station at St. George, Staten Island, on the night of August 3. How complete was the destruction of this plant will be seen from the illustrations given herewith. Evidences of the intense heat caused by a fire which swept absolutely unchecked throughout the whole outfit, are to be seen at every point. The only matter for satisfactory reflection to be observed in these pictures is the admirable quality of much of the material used in the equipment, that is shown by the manner in which it has come through the fiery ordeal. The necessity for fire-proof stations is absolute. The future and prosperity of electrical service lies with the people whom it serves, and everything possible must be done to insure the continuance of that service.

Many of the latest constructed stations possess admirable points, and embody much that the best practice and the most tried experience have suggested; but in this one respect of guarding against fire a distinct advance will have to be made in the construction of future stations. They will have to contain not only the smallest possible amount of combustible material but they will have to possess the facility for isolating their respective departments in the same way as the water-tight compartments in modern steamers provide against the contingencies that may arise in case of injury to any part of the ship. No engineer should permit an electric station to contain features that will aid combustion.



RUINS OF THE ELECTRIC LIGHT STATION AT ST. GEORGE, STATEN ISLAND.

The station at St. George was one of the largest alternating current stations in the vicinity of New York, and was considered a model installation.

To illustrate: were this system of isolation carried out, should a fire start in the boiler room, and that part of the plant be crippled, temporary boilers would enable the manager to supply light, his dynamos and other apparatus being unharmed, or, were the dynamo room to burn out temporary apparatus could be provided to continue the working of the plant. In either case the catastrophe would not be crushing, as in the instance under discussion. This fire started from some cause in no way connected with the electrical apparatus. The building was of such an inflammable nature that the flames spread with almost lightning rapidity, and the work of destruction only ended when there was nothing further to burn, the firemen being powerless to arrest it. The destruction was so complete that it will be difficult to rebuild on the old foundation, or even erect a temporary station. As most of the customers of the station depended solely upon the electric current for their light, the loss of patronage alone will reach no small figure.

A peculiar feature of Staten Island is that its numerous small towns are widely scattered and the station furnished current for an area of about twenty-five square miles. The widespread inconvenience and loss which has been caused by this event, serves to emphasize the necessity of the provision in the station buildings of the future of such safeguards as have been here suggested. The user of the electric light learns to appreciate it for its cleanliness, convenience and economy. That the light itself possesses virtues no other illuminant enjoys, is not sufficient to insure its universal adoption. The manager, the promoter and inventor must help by judicious effort to render electric service reliable. This assured the paramount success of the electric light over all other illuminants is but a matter of time.

ELECTRIC LIGHTSHIP.

Plans and specification for the construction of a lightship, to be equipped with an electric light plant, have been drawn by the United States Lighthouse Board, and bids have been advertised for. The vessel is to be stationed off Cornfield Point and will be known as Lightship Number 51. The specifications for the electric light plant provide for two horizontal high-speed engines, capable of developing eight horse power at a normal speed, with seventy pounds steam pressure. Compound wound dynamos, capable of generating sixty amperes at a pressure of 110 volts, are to be used. They are to be regulated automatically and so constructed that a change in load will not require a readjustment of the brushes. The commercial efficiency of each machine must be at least eighty per cent. The arrangement of the dynamos and engines is to be such that either engine can be coupled to either or both dynamos. The engines are to be connected to the dynamos by Evans' friction cones. The space to be occupied by the plant is eight and one-half by eleven feet. The lights at the masthead are to be located at a height of fifty feet, and the circuits are to be so arranged that they can be alternately opened and closed by a device attached either to the dynamo or engine. The arrangement is to be such that the circuits may be opened and closed at intervals of from five to twenty seconds. Eight 100 candle-power and twenty 16 candle-power lamps are to be wired up on the double-wire system. The ship, when finished, will be the first of its class to be supplied with a complete electric light outfit, and it is expected to be the best in the lightship service.

MINNEAPOLIS-ST. PAUL ELECTRIC RAILWAY MAIL SERVICE.

The first electric road designated to carry United States mails is the interurban line that forms a bond of union between the Twin Cities. The new mail service insures the transmission of letters between St. Paul and Minneapolis every half hour. The cars selected to carry the mails bear United States flags and lemon-colored mail boxes. It would hardly do to use the familiar green boxes, for the color would be out of harmony with the immediate surroundings, and it would look, too, as if the boxes had deserted their lamp posts for the sake of taking a ride. The new system proved successful on the first day and the interurban electric postal route is a fixture. It is proposed now to place a box on every car in order to offer still better facilities for the transmission of compliments and business communications between the two cities.

CHICAGO DRAWBRIDGE OPERATED BY AN ELECTRIC MOTOR.

Rush street bridge, one of the largest drawbridges in the world, was operated by electricity for the first time last week. This structure, situated near the mouth of the Chicago river, is probably opened and closed as often as any drawbridge in the United States. It has been turned, up to the present time, by a forty horse power steam engine, mounted between the center trusses and about twenty feet above the flooring. The engine is connected to a vertical steel shaft extending below the floor girders which, in turn, is geared to the transverse shaft running from the centre of the turntable to the cogged gearing on its circumference.

The Thomson-Houston motor used in the experiment is of twenty horse power, and similar to those used on the larger street cars equipped by the company. The attachment to the transverse shaft is the same as to the axle of a street car and motion is transferred from the armature by means of four reducing gears. The motion of the armature and the position of the motor are such that

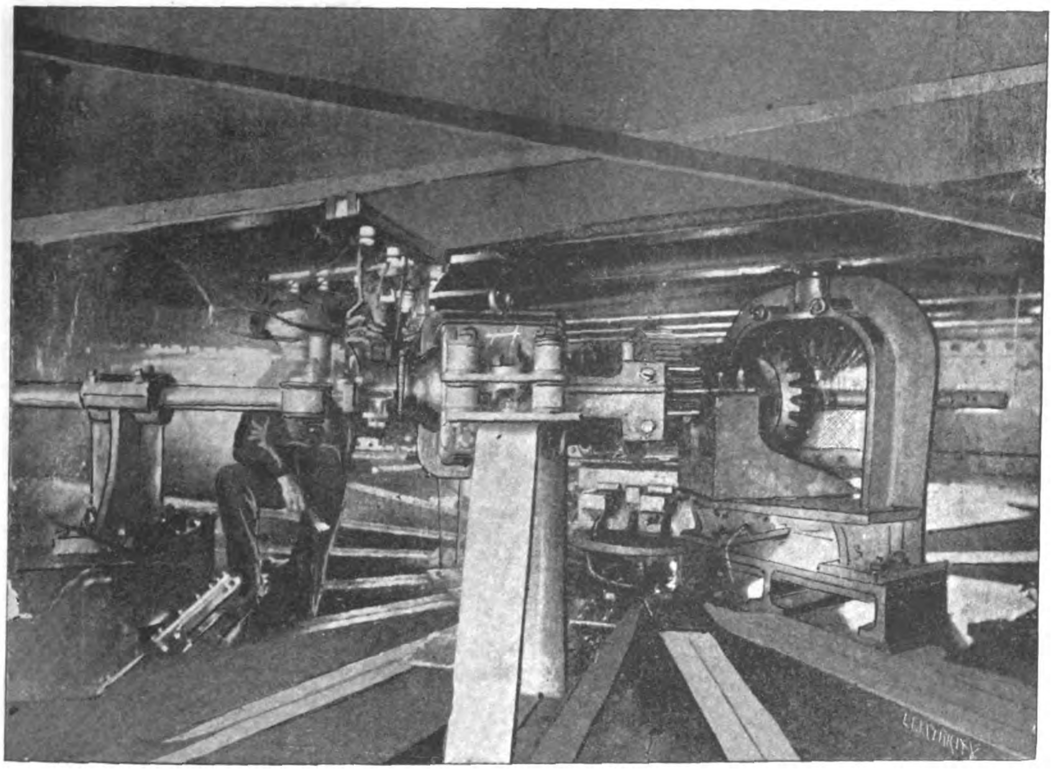


FIG. 1—CHICAGO DRAWBRIDGE OPERATED BY AN ELECTRIC MOTOR.

the vibration so noticeable when the bridge is operated by the engine, is overcome. The motor is located under the platform of the bridge, and hung near the centre of the shaft. It is controlled by a rheostat which, placed between the two tracks on the platform of the bridge, is within easy reach of the bridge tender. The rhesotat is similar to those used in connection with the Thomson-Houston street car system. It is connected to the motor by tapping the fields in two places, thus allowing greater range of speed, and placing the operation of the bridge under better control of the person in charge.

Current is supplied by the Chicago Arc Light and Power Company, through its regular 500 volt motor circuit. The cable is run on the bed of the river from the south pier to the center pier and connection is made to the motor by a double trolley, as shown in Fig. 2. Two copper wires, forming a circle as shown at *B* and *C*, are supported on insulated brackets around the base of the turntable; one of these is used as the feeder, the other as the return wire. As the bridge moves round, two small wheels mounted on the end of short insulated rods, are caused to press constantly against the wires by a set of springs.

Rush street bridge is the first in Chicago to be operated by electricity. If the experiment proves successful after sixty days' trial, doubtless other bridges of the city will be equipped with motors to replace steam engines. The use of a motor will save over $150 per month for each bridge. The services of the fireman can be dispensed with, and all the inconveniences caused by smoke, dirt and the cartage of fuel will be avoided.

The motor and apparatus were installed by G. B. Seaman, under the plans of Geo. P. Nichols, of the Thomson-Houston Electric Company, Chicago.

"POPULARIZING THE ELECTRIC LIGHT."

BY G.

In this country we have for a long time past considered our British cousins as somewhat behind the times, according to our own standards, in adopting the electric light on a general scale. Until quite lately, there have been good reasons why public lighting by electricity should not progress as rapidly in England as it has in this country. The chief of these was the unfavorable piece of legislation which throttled private enterprise by empowering municipalities to buy up electric lighting systems at their own price at the end of an absurdly short term of exploitation by the installing companies. This act, after a long struggle by the champions of electricity, has lately been repealed, or at any rate sensibly amended, and during the last two or three years a veritable boom in electric lighting has been occupying the attention of English electrical engineers.

So widespread is the renewal of interest in electric lighting, that plans have already been made out for large central stations in the more important commercial centers in the United Kingdom, and the city corporations and town councils of almost all the large centers of population are asking for plans and tenders, employing consulting engineers, visiting other towns and cities where the electric light is already in use, and in every possible manner showing a commendable desire to learn all they can about electricity and its advantages over gas as an illuminant. With this object in view the English Association of Municipal and County Engineers recently paid a visit to London to inspect the numerous important electrical works—lighting and otherwise—in operation in that city. During their London meeting they listened to an extremely interesting and instructive lecture by W. H. Preece on the relative merit and cost of gas and electricity for lighting purposes.

Mr. Preece's lecture was too long for us to review point by point, and as his figures of course apply entirely to English practice and prices, it would scarcely profit readers were we to do so, but some of his statements—the result of actual experience—are of too great interest to be passed over. In England the charge for electrical energy is based on a unit of 1000 watts for one hour, the kilowatt hour or Board of Trade unit. Reducing this to American practice, we find that one kilowatt for one hour would light twenty 16 candle

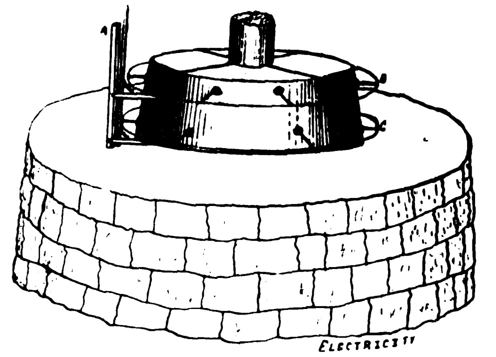


FIG. 2—DRAWBRIDGE OPERATED BY AN ELECTRIC MOTOR—CONTACT DEVICE.

power incandescent lamps for that time. The price charged in England for electrical energy varies considerably; in London some companies charge 14½ cents per kilowatt-hour and others 16 cents; in Bradford the charge is 12 cents, and in Newcastle only 9 cents, with a discount of 20 per cent. to large users. The lamp generally used in England is nominally of 8 candle power, as it is held that with this size of lamp a better distribution of the light is obtained than with the larger lamps; this lamp consumes 33 watts, so that at the lowest price named above the cost per lamp per hour is about three-tenths of a cent.

In England the electric light has to compete with very cheap gas. The Parliamentary standard for gas is that when burned at the rate of 5 cubic feet per hour, it shall give a light of 15-candle-power. The ordinary burner, however, only gives about 10 candle-power, a fact determined by careful investigation and experiment, so that in point of illumination the 8 candle-power glow lamp and the ordinary gas burner are about on equal terms. Mr. Preece finds that where gas costs about 90 cents per 1000 cubic feet, electricity costs $1 for an equal amount of light. This is curiously borne out by the average price paid per burner for gas and electric light in the large towns of the United Kingdom. In nine large towns the average price per gas burner per annum is $2.25; the average price of gas being 75 cents per 1000 feet. The average price per lamp per annum paid by the consumer to the electric light provider is $2.50. In the General Post Office in London, where a great amount of light is needed, an electric light plant has been in operation for two years, and the ratio of cost between gas and electricity is found to be 9 to 11 instead of 9 to 10 as in the previous comparisons.

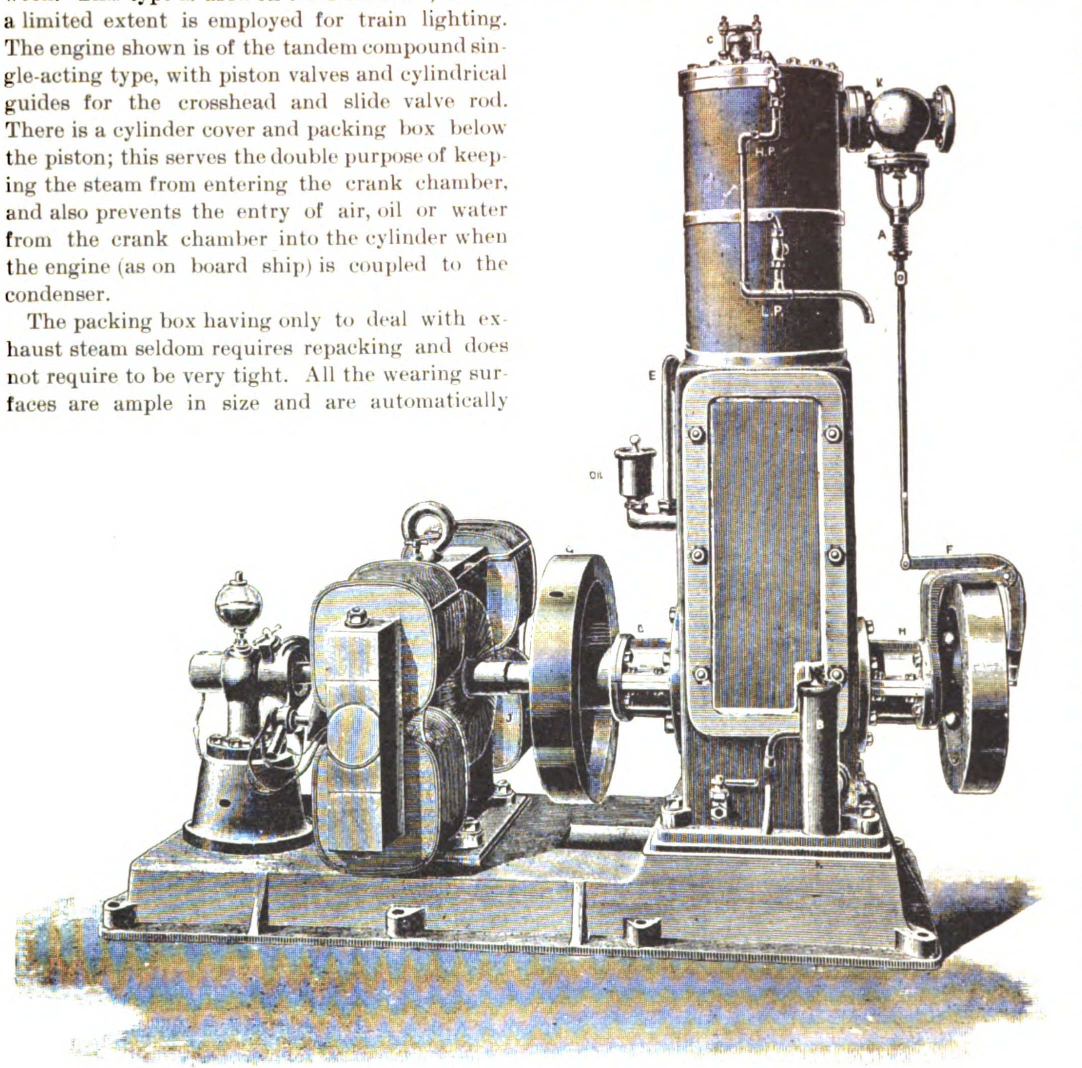
Another important point made by Mr. Preece is the relation of the electric light to health. "The purity of the air you breathe, the sanitary aspect of the electric light, is the point and aspect which commends it so much to municipal engineers and local authorities." In the Savings Bank Department of the General Post Office the cost of the electric light is actually paid for by the increased service which the staff is able to perform. The electric light has effected a saving of $3,400 a year, diminishing the amount of absence through sickness caused by bad air and poor light. The total annual cost of the electric light is $3,500, so that

it really only costs $100 a year as compared with gas. In the General Post Office, where the electric light was introduced just before Christmas, the Chief Controller said that the light was equal to 200 men. In Mr. Preece's opinion, the duty of a corporation is to look into the matter of electric lighting, from various points of view, financial, political, sanitary, and above all, philanthropic. The electric light is the light of the future, and not the light of luxury, but the poor man's lamp.

COMBINED ENGINE AND DYNAMO.

The combination of the dynamo and engine shown in the illustration is interesting because of the small space which the machines occupy. They cover only a space of two by four feet and the height of the engine is four feet. Plants of this type are now used on a large number of transatlantic steamers. One of this description furnished current for lighting on board the "Majestic" of the White Star Line which broke the ocean record last week. This type is used on the Nile boats, and to a limited extent is employed for train lighting. The engine shown is of the tandem compound single-acting type, with piston valves and cylindrical guides for the crosshead and slide valve rod. There is a cylinder cover and packing box below the piston; this serves the double purpose of keeping the steam from entering the crank chamber, and also prevents the entry of air, oil or water from the crank chamber into the cylinder when the engine (as on board ship) is coupled to the condenser.

The packing box having only to deal with exhaust steam seldom requires repacking and does not require to be very tight. All the wearing surfaces are ample in size and are automatically



Combined Engine and Dynamo.

lubricated by the running of the engine; a continuous stream of oil and water circulates along the crankshaft brasses D, and H, and is driven back by a small turbine when near the outside end of the brasses, thus no crankshaft packing boxes are required, and the engine friction is very light. The speed is governed by a flywheel governor F, connected by a rod A, to the valve K. A second flywheel C, is interposed between the engine and dynamo. The engine is made with a single crank as shown, also with a double crank and a treble crank (self-starting).

The engine and dynamo shown in the illustration run at 500 revolutions and the engine indicates about six and one-half horse power with 125 pound steam. The dynamo has a ring armature of the type in general use by Messrs. Crompton; it is fifteen and one-half inches in diameter and five inches long, the radial depth of the disks being three inches. The armature is built of thin disks on a cast spider; this arrangement, while thoroughly strong, admits of good ventilation. The maximum rise of temperature ascertained after a long run is only thirty degrees Fahrenheit. The output is 100 amperes at fifty-five volts.

The dynamo was made by Crompton & Co., of Chelmsford, England, and the engine is of the Chandler type.

ELECTRICAL CURRENT TOPICS.

"I read with interest the description of the electrolytic plant for the production of hydrogen and oxygen in Electricity last week," said a reader, "and I thought of a new use that there might be for such a plant. I have lately read of the experiments for producing rain. Balloons filled with hydrogen and oxygen forming a violent explosive, were exploded at a height of from 1,800 to 3,000 feet above the ground. I believe that the mixture of gases is in the proportion of two of hydrogen and one of oxygen, just the proportion obtained by the decomposition of water. Now if these experiments are to be conducted on any extensive scale, as the papers state, the installation of a plant such as Renard has made would perhaps be both economical and convenient."

* * *

One of the disadvantages of the cable system was strikingly illustrated last week in Chicago. During the million dollar fire which destroyed Siegel, Cooper & Co.'s store, and injured half a dozen adjoining buildings, the two cable roads on the South Side came to a stand-still. From 7:30 in the morning until afternoon no cars were operated north of Twenty-second street. The cars forming an imposing line, simply remained idle till the track was cleared of hose. Had electric cars been used which can be reversed, only a short section of the two lines would have been cut out. The rest of the line would have been operated as usual, and thousands of persons would have been saved a temper-souring walk of two miles. The cable system beyond a question works well on the South Side ordinarily, but when a weak point develops, it impresses itself with great effectiveness on some thousands of people.

* * *

The statement is going the rounds of the press that the use of the electric lights in the London General Post Office saved the English government several thousand dollars last year because the illness of employes was much less frequent than it had been during the years when gas was used. There is doubtless a good deal of truth in the statement; therefore the story is not to be classed in that familiar category of hyperboles, the most prominent example of which is that the Bank of England saved £1,500 one year for ink by instructing its employes not to dot i's or cross t's.

* * *

There have been two young men engaged in imposing on residents of the North Side, Chicago, so the story goes. Their stock in trade consisted of a steel tape line and a piece of chalk. They would measure off distances in front of some popular resort and finally make an "X" mark in front of the main entrance. Their actions would naturally lead to queries and the conversation would naturally take this turn:

"What are you doing?"

"We're locating poles for an electric railway."

"You are not going to put one out there in front of my place, are you?"

"Yes, that is where it should come."

"Well, come inside a minute."

Visiting the interior of the resort the prospectors would be hospitably received and would, perhaps, be given a slight honorarium for locating the pole at some other point. It is said that these sharpers did quite a thriving trade till their swindle was exposed.

* * *

There has been a deal of talk of electric signaling of late. The White Squadron in New York Harbor gave some very pretty illustrations of the possibilities of signaling. What has been done is as nothing compared with what must be accomplished by the winner of $20,000, recently left by a French woman as a prize to the person who will devise means of communicating with the planet Mars. A Chicago astronomer has made several estimates in connection with the problem. To form objects to be seen on the planet it would be, says he, necessary to have electric lights twenty miles in diameter separated by similar distances. After these were provided for the signals would have to be arranged in some form so that they could be readily understood by the Mars' astronomers. This would be quite a task even for the most accomplished linguist. By the time these problems were solved the inventor would deserve his $20,000.

* * *

Electricity is already applied to the race course in a variety of ways. Several driving associations this year are considering innovations. Peoria, Ill., horsemen are thinking of holding races at night, illuminating the track by electric lights. It is proposed to do the same thing at the State Fair races at Des Moines. Poles are to be set every fifty feet around the track, on which thirty-two candle power incandescent lamps will be monted. In Denver the scheme under consideration is much more elaborate. The local club, according to the papers, proposes to construct a circular electric railway just outside the track. The judges will occupy a car and will keep even with the horses around the course so that they can watch the jockeys continually. The car, perhaps, might be used to advantage to set the pace for the horses when they are speeding.

* * *

Is it possible that the telephone is to be used in such a scheme as is now talked of earnestly in Geneseo and Mt. Morris, N. Y? The former place is a strictly no-license town; in the latter place the

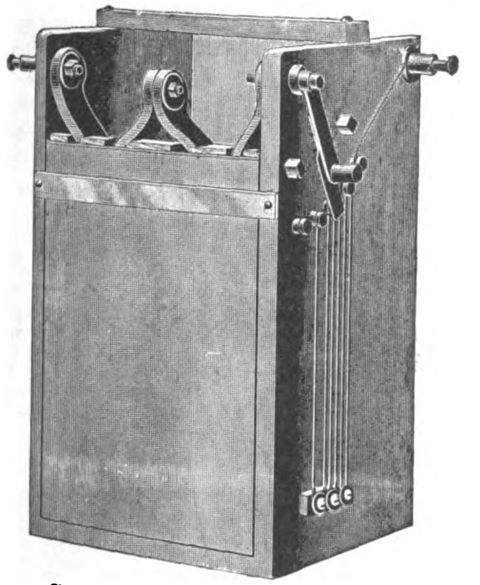
liquor traffic is flourishing. It is proposed to run a pipe line from Mt. Morris to Geneseo and send a certain beverage through it to the prohibition town. A telephone line would connect the two pipe stations so that orders could be transmitted with despatch. Those interested in the scheme are quoted by a local paper as saying that the traffic could not be interfered with in Geneseo for the beverage would be bought in Mt. Morris.

* * *

A Chicago confectioner has adopted a very pretty scheme to lure victims into his store. On the counter right by the door is located a fan of fair dimensions. Its office is not to create a circulation of air in the place; far from it. The machine was installed to blow the odors of candy out into the street, so that by the stimulation of the olfactory nerves, gustatory desires might excited. The appeal is said to be very effective, and the fan is kept in operation during days that are not known as "fan weather." This story is told just as it was related, and its accuracy will not be vouched for. It should be true. The following incident, which it recalls, is absolutely authentic as a considerable number of readers will be able to testify: A clergyman was called upon to make an address before boys in a reformatory. He began by describing the measures adopted by the wicked to ensnare the easily tempted. As an illustration he stated it to be a fact that saloonkeepers made it a practice to place in front of their doors sawdust which they sprinkled liberally with spirits. The fumes arising excited a desire for drink in those who came near the saloon and they speedily entered the premises,and soon came to ruin. It did not take the boys long to come to the unanimous conclusion that some one had been imposing on the good speaker. That his attention was not called to the fact in a most emphatic manner was due to the admirable discipline of the institution.

MEDICAL STORAGE BATTERY AND RHEOSTAT.

In the accompanying illustration is shown a storage battery and rheostat combined, that were designed to supply an increasing demand for a portable storage battery for medical purposes. As will be noticed in the cut, the rheostat instead of being a separate device, is mounted on the side of the battery case, a neat and handy arrange-



Storage Battery and Rheostat.

ment. The battery and rheostat illustrated are especially adapted for galvano cautery operations, or for similar work, requiring a large flow of current with slight variations. The battery has a capacity of 20 ampere-hours. The e. m. f. is 2 volts and the maximum rate of discharge is four amperes. For dental work or running small motors, a larger number of cells are placed in combination with a rheostat of greater range. The outfit is manufactured by Walter Simpson of Chicago.

ELECTRICAL CLAM BAKE.

THIRTEENTH GATHERING AT VUE DE L'EAU. - SPORTS AND SPEECHES.

Special Correspondence.

Boston, August 10, 1891.– Whatever may be the triumphs of the electrical fraternity, they are not successful weather prophets. This statement was strikingly proved on Saturday last, when quite a number included among the prospective guests of the American Electrical Works, Providence, undertook to cast their weather-eyes around the horizon and predicted on Friday afternoon and evening a bad day for the celebration of the thirteenth annual clam bake at the Vue de l'Eau Club, situated on the picturesque bluffs overlooking the beautiful river of Providence.

The boys were inclined to be a bit superstitious for once about the number thirteen, but their predictions availed not. True, just before midnight Friday, and for an hour or so Massachusetts in general, and Boston in particular, received a drenching such as it has not known for many a long day. In fact, it seemed as though there could not be another single drop left in the clouds, and that may have been the reason why Saturday morning broke bright and bracing, to the intense delight of the Boston contingent. As early as eight o'clock the pleasure-seekers began to wend their way to Park Square station, whither they were followed at nine and ten by those who knew that the day, though an hour or two shortened at the beginning, would be a merry one.

By eleven all had reached Providence and were soon basking in the hot sunshine on the lawn of Vue de l'Eau, the favorite trysting place of the electric fraternity. Here were already gathered friends and acquaintances from far and near. Here also was assembled a strong contingent from New York. After the handshaking and welcomes were concluded, the registering of names and fixing of badges took but little time, and an onslaught was made on the lunch. Then the sports began in right good earnest. Rifle practice, football, striking tests, lifting tests, magnetic machines and other amusements were provided, a spirited and well contested base ball game between New York and Boston teams of course being included in the program.

Realizing that the day would prove a scorcher, Eugene F. Phillips had provided an abundant supply of broad brimmed straw hats, which were speedily donned, and saved many a tender face from blisters. These as well as fish horns intended to scare away the mosquitoes were particularly useful. A first-class orchestra was in attendance and in the intervals when the horns were given a rest choice selections were played.

As it has been stated the old proverb about the unlucky number, 13, didn't apply to this clambake, for it was more numerously attended and more fully enjoyed than any of its dozen predecessors, and that is saying a great deal, when those gatherings in former years are remembered.

On this occasion the Honorable Herbert W. Ladd, governor of Rhode Island, and the Honorable C. Sydney Smith, mayor of Providence, were among the guests, who numbered 209, all told, and were as follows:

E. D. Lloyd, Boston; L. G. Banker, Boston; G. M. D. Fernald, Boston; C. E. Stump, New York; F. C. Baker, Topeka, Kan.; W. B. Cram, Boston; H. D. Sears, Lynn, Mass.; A. J. De Camp, Philadelphia; G. A. Harrington, Boston; P. H. Alexander, New York; H. C. Fish, Boston; E. R. Tilton, Boston; C. W. Price, New York; A. D. Blodgett, Boston; R. H. Walker, New York; E. D. Moore, New York; J. H. Bates, New York; J. A. Cooney, New York; J. F. Carney, New York; Jos. Taylor, Boston; E. C. Caldwell; New York; M. C. Clemens, Attleboro, Mass.; H. P. Stanwood; Boston; H. M. Nichols, Boston; L. W. Dillon, Attleboro, Mass; E. E. Wood, New York; W. H. Babcock, Hartford, Conn.; G. F. Porter, Philadelphia; G. L. Austin, Boston; G. M. Phelps, New York; S. L. Coles, New York; H. B. Cutter, Philadelphia; C. E. Bibber, Boston; W. H. Stadler, New York; Harry Stewart, Greenville, N. Y.; W. J. Johnston, New York; G. D. Longstreet, New York; W. T. Barker, Boston; H. H. Sherman, Auburn, R. I.; J. O. Darling, Providence, R. I.; J. B. Tatum, Putnam, Conn.; Owen Durfee, Fall River, Mass.; W. T. Hunt, New York; W. McGregor, Pawtucket, R. I.; E. C. Stiners, Pawtucket, R. I.; H. B. Emery, Boston; L. M. Clarke, New Haven; C. J. Birkmayer, Stamford, Conn.; V. A. Thomas; Providence; C. A. Grant, Lowell, Mass.; G. H. Walbridge, New York; Levi Cofren, Boston; F. Burdock, Newton, Mass.; W. E. Holmes, Newton, Mass.; C. H. Herrick, Boston; F. Luther, Boston; J. C. Keefe, Syracuse, N. Y.; A. P. Seymour, Syracuse, N. Y.; F. Cicott, Chicago, Ill.; F. H. Harrington, New York; F. E. Bisbee, Auburn, Me.; W. B. Griffin, Stamford, Conn.; T. H. Bibber, Boston; F. A. Gilbert, Boston; G. H. Almon, Boston; W. E. Gier, Boston; R. W. Pope, New York; W. H. Sawyer, Providence; E. B. Baker, New Haven, Conn.; G. W. Phillips, Norwich, Conn.; B. F. Hamilton, New York; E. F. Phillips, Providence; E. M. Carhart, Providence; J. M. Hollywood, Brockton, Mass.; H. A. Cleverly, Philadelphia; H. A. Day, Boston; N. B. Denison, Pawtucket, R. I.; E. W. Fyler, Boston; H. G. Wright, Providence; N. H. Poor, Harrinville; C. E. Locke, Pawtucket, R. I.; H. L. Greene, Riverpoint, R. I.; Herbert W. Ladd, Providence; J. S. Reed, Providence; A. L. Rogers, Lynn; W. B. Lewis, Lynn; F. C. Chapin, Providence; E. C. Hughes, Providence; A. O. Smith, Providence; L. H. Hart, New York; M. W. Brown, Boston; G. D. Layward, Providence; G. W. Foster, Andover, Mass.; J. E. Whitney, Andover, Mass; J. H. Craig, Boston; R. S. Taber, New Bedford: J. W. White, Providence; W. J. Thurston, Providence; C. A. Baldwin, Boston; F. H. Lord, New York; F. H. Hopper, New York; W. H. Clancy, Riverpoint, R. I.; W. W. Turner, Boston; F. W. Crocker, Boston; H. L. Pierce, Leominster; J. J. Gates, Hartford, Conn.; C. G. Perkins, Hartford, Conn.; C. P. Chappell, Providence; Aug. Wright, Providence; Ed. Byrnes, Providence; W. T. Nialle, Worcester; A. Coleman, Taunton, Mass.; W. K. Wagner, New Bedford; G. Darling, Providence; H. C. Bradford, Providence; R. S. H. Brown, New York; C. C. Fry, Lynn, Mass.; E. F. Peck, Brooklyn; W. E. Bigelow, New Britain, Conn.; C. D. Morse, Millbury, Mass.; W. C. Woodward, Boston; W. Whitman, Leicester; A. I. Bufford, Hopedale; A. C. Shaw, Boston; Isaac F. Baker, Lynn; C. Brongher, Boston; E. D. Bailey, Windsor Locks; S. D. Lockwood, Boston; J. M. McGown, Providence; W. Tinkham; Providence; G. L. Davis, Boston; H. H. Fairbanks, Worcester; W. H. Coughlin, Worcester; H. F. Woods, Boston; F. M. Kimball, Boston; S. W. Derford, Boston; F. J. Boynton, Boston; F. M. Gilley, Boston; J. K. Butler, Boston; E. M. Wilson, Pittsfield, Mass.; J. Tregoning, Providence; John T. Drake, Providence; D. J. Coburn, Chelsea; J. H. Clarke, Boston; C. N. Whiting, Boston; J. S. Keenan, Boston; L. S. Dumoulin, Boston; G. S. Stump, Pawtucket; W. S. Key, Boston; E. R. Phillips, Providence; N. W. Hamblin, Portland; P. C. Ackerman, New York; M. C. Day, Providence; Frank Ridlon, Boston; G. H. Heathcote, Providence; W. E. Decrow, Boston; N. W. Lillie, Boston; C. A. Vialle, Boston; C. R. Remington, Providence; F. E. Pettingell, Boston; C. G. A. Peterson, Providence; L. G. Holst, Providence; A. P. Crowley, Providence; H. C. Langstaff, Providence; R. Whitten, Providence; J. E. Andrew, Pawtucket; T. Elwood Smith, Lomerville; W. W. Dempster, Providence; H. J. Pettengill, Boston; W. A. Leaman, Newton; A. D. Wheeler, Boston; D. L Fales, Pawtucket; S. R. Payson, Providence; G. R. Stetson, New Bedford; R. C. Breck, Bridgewater; W. H. Hathaway, Providence; J. L. Lucas, Boston; S. S. Sherman; C. B. Burleigh, Boston; F. S. Butwhistle, Brockton; M. P. Burbank, Whitinsville; G. Wilmot, Uxbridge; C. H. Barnes, New York; C. W. Whitney, Jr., Boston; A. C. White, Providence; G. F. Hedge, Jr., Providence; H. F. Kellogg, Providence; C. Sydney Smith, Providence; L. C. Whitney, Providence; G. W. Adams, Boston; E. C. Perkins, Providence; G. A. Steere, Providence; C. H. Williams, Providence; J. Carroll, Montreal, Can.; J. W. Poole, Boston; C. P. Lang, Boston; C. W. Baker, Providence; J. B. Straw, Boston; J. P. Felton, Boston; E. J. Garfield, Boston; W. N Munro, Providence; E. A. Smith, Providence; A. C. Barstow, Providence; D. A. Andrews, Boston; J. C. Hamell, Bristol, R. I.; G. H. Thurston, Providence; B. I. Keek, Providence.

As is usual at these "bakes," a photographer was on hand to take a shot at the crowd, and it proved to be no slight undertaking to "fix" such a lot of merry-makers, and over half an hour was consumed in the effort. But after patiently waiting for some time two snap shots were taken, and then there was a stampede to the dining tent, where for two hours was to be discussed a genuine Rhode Island menu.

Ample justice having been done to the repast and coffee brought in, Mr. Phillips announced that Thos. D. Lockwood would act as toastmaster for the occasion.

Mr. Lockwood, on rising, referred to the repeated occasions on which they had met together to share the hospitality of their generous host, who seemed never to weary of providing enjoyable meetings for those who were engaged in the various branches of the electrical business. Whether or not all who had received Mr. Phillips' annual invitations were present, everyone fully appreciated the generous spirit which prompted their host, and he was pleased to call upon that gentleman to say a word or two.

Mr. Phillips in response, welcomed all in the name of the American Electrical Works, and trusted that it might be his pleasure to welcome them again in years to come.

Governor Ladd was next called upon and in a facetious speech referred appreciatively to the important work that was being accomplished by those he saw around him. As an excuse for not detaining his hearers long, his excellency closed with a laughable story which brought down the house.

A. J. DeCamp, as a pioneer in the electrical business, alluded to the rapid growth and the wonderful developments which had taken place in the business in which they were all interested.

Mr. Lockwood then, very happily, introduced the mayor of Providence, who in turn elicited roars of laughter from all present by his witty stories and pleasant reminiscences. He spoke appreciatively of the advantages to the world which the electrical fraternity was presenting, and amusingly commented on the youthful appearance of those he saw around him.

In referring to what had been said about the rapid growth of the electrical business Mr. Lockwood paid a tribute to the value of the electrical press, calling upon two well-known representatives of journalism to respond. Ralph W. Pope and G. M. Phelps, formerly actively engaged in the electrical business, and now representing the press, delivered brief and interesting addresses, after which Martin Day, of the Providence *Journal*, entertained the company for ten minutes by a running fire of witticisms, quaint remarks, laughable stories and weighty advice, which fairly convulsed every one and formed a capital conclusion to a most enjoyable repast.

Amid the explosions of innumerable fire crackers and the exultant cheers of all, a move was then made for the steamboat landing, and after a run up the river the party divided, each one wending his way homeward by the train delighted with the outing, an unanimous feeling prevailing that this, the thirteenth, was the best and most successful of the American Electrical Works annual clam bakes.

W. S. K.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

Prof. J. P. Barrett, chief of the Department of Electricity, has started East on an extended trip in the interest of his department. He expects to visit Pittsburg, Boston, New York, Philadelphia and other large electrical centers. It is his intention to spend a day or more at the national convention of the Fireman's Association.

Letters are continually pouring into the Electrical Department asking for allotment of space. Among the number received last week was one from James W. Queen & Company, of Philadelphia, asking for 300 square feet from the Electrical Department. This firm expects to divide its exhibit, placing a part of it in the Department of Liberal Arts.

Considerable trouble is experienced by the Electrical Department in making intending exhibitors understand that nothing but exhibits pertaining to electricity can be displayed in the Electricity Building.

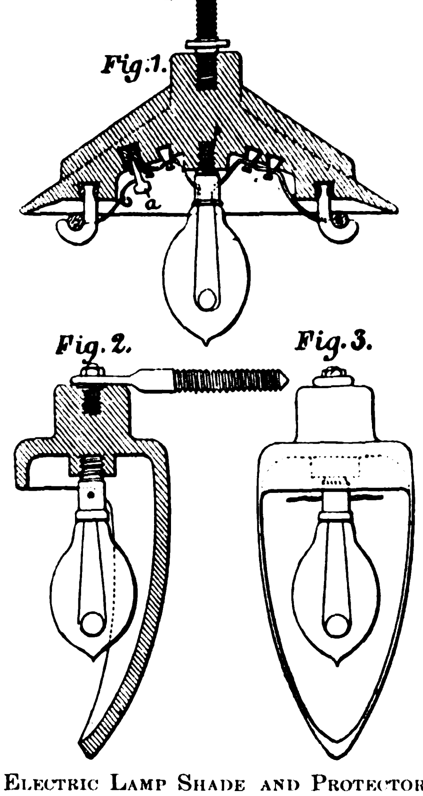
LONDON UNDERGROUND ROAD AND CHICAGO.

James Fairfax, a London electrical engineer, was interviewed when in Chicago a few days ago. He said he had noticed that Americans understood electrical matters far better than the English people. The latter were slow, he said, to take hold of a new thing. Speaking of the Greathead electric railway in London he said:

"The opening of the electric subway in London exceeds every thing else of importance. It was put in operation last December. Although the engineers recognized at the time the full importance of the opening of the subway, they did not dream that it would make so deep an impression on the public mind. The English people heretofore have had no idea generally of the practicability of electrical machinery. But the application of electric power for the purposes of practical engineering has received a wonderful impetus since the opening of the electric subway. The great fact of the day in England is the conveyance of a million or more passengers through the London electric subway. The impression this has made upon the minds of the educated public who are not scientifically informed has been of great advantage to the electricians and engineers. By the way, I see you are talking of having an electric subway in Chicago. If it could be constructed without too much expense it will be the thing to relieve your crowded streets. I don't see now how you can accommodate the vast crowds that will attend the World's Fair when it comes to hauling them through the down town section of the city. These cable cars over here are man-killers. If you are fortunate enough not to be knocked down and run over on the streets and can catch a car you will, ten to one, be compelled to dangle at the end of a strap like a striking bag in a gymnasium."

INCANDESCENT LAMP SHADE AND PROTECTOR.

Two forms of lamp shades and protectors are illustrated herewith. A great variety of such devices has recently been brought out to meet the demand for higher insulation in connection with electric light plants in mines, packing houses, tanneries and in other places where dampness is to be found. The two forms of the shield are shown in the engravings. Fig. 1 indicates the form adopted when the lamp is fixed to the ceiling or roof of the gallery where it is used. By means of the screw shown at the top it can be secured in position with the greatest ease. The hooks shown



Electric Lamp Shade and Protector.

on each side of the lamp are used for carrying the mains, while a switch or a cut-out for the lamp is shown at *a*. The shade shown in Fig. 3, of which Fig. 2 is a cross section, is intended to protect the lamps when the latter are hung from the walls or partitions instead of from the roof. As the shields are made of white porcelain they not only guard the lamps from injury, but also form capital reflectors, and considerably increase the efficiency of the lighting. The devices in question are the invention of R. O. G. Drummond, of Kimberley, South Africa.

WHAT IS SAID OF "ELECTRICITY."

Inland Printer.

It is well printed, and it seems to have a long-felt want to fill, in that it aims to cover its field in a popular and practical way as well as technically.

New York Commercial Advertiser.

It is illustrated and contains much miscellany that is interesting. They should advertise, "If you want to live, take Electricity."

Bridgeport (Conn.) Herald.

Unlike many class periodicals, it is not entirely technical but aims to be popular as well. And it is undoubtedly bound to become so. The illustrations are well gotten up and timely, the reading matter is carefully selected, and all news of interest in the electrical world is well covered.

New York World.

Its proclaimed purpose is to make the science of which it treats popular and practical, and to avoid in a measure the strictly technical treatment which now marks the majority of the great number of electrical journals. The new paper is finely printed and freely illustrated, and in its first number lives up to its claims.

Electrical Review, New York.

The first issue of the new weekly is typographically excellent, and contains more than the usual amount of news and advertising found in a first effort.

Electrical Age, New York.

As regards the paper, it is handsome in appearance, and its typography is of a high class. The title of the paper is striking in its simplicity, and the combination of colors on the cover is very pleasing to the eye. It is the purpose of the publishers to devote particular attention to the popular exposition of electrical progress. They will not sacrifice technical discussions, however, their object being to produce a paper that will interest the uninitiated as well as the most technical expert in electrical matters.

Engineering Record.

The three numbers thus far issued are bright and attractive in appearance and comprise a variety of matter of electrical engineering interest.

Engineering News.

The first number is dated July 22, and if succeeding numbers compare with this in excellence and profusion of illustrations, typography and in general selection and arrangement of matter, it will get on. The aim of the editors is evidently to introduce more popular matter in this branch of science than is usual among electric journals.

SOME NOTES ON INSULATION.

BY HERBERT LAWS WEBB.

Part II.

The telephone engineer holds much the same position with regard to insulation as his confrere of the telegraph. In the early days of the telephone it was held by many that in telephone work insulation did not matter much, and that a telephone line would work well enough even with a bare wire laid on the ground. The fallacy of this was soon proved, however, and good insulation is insisted on in all parts of a telephone system. In telephone lines the important condition required is low capacity, and this requisite is what makers of telephone cables are constantly striving after. At the same time the telephone man would also like a low insulation, but he cannot get it because materials which have a low insulation resistance always have a high capacity, or else they are not durable. Therefore he is content to get as low a capacity as possible with a high insulation. The materials which can be used for insulating underground telephone cables are comparatively few in number. India rubber and gutta percha are barred out, because of their high inductive capacity. The cable-makers fall back on fibrous materials, such as cotton, hemp, paper, etc., which they saturate with paraffine, or compounds of the heavy oils and pitch, enclosing the whole in a lead sheathing. The disadvantages of a cable of this sort is that it is readily affected by heat, the insulation falling very rapidly as the temperature rises, and that the insulating material being very hygroscopic, any damage to the lead pipe results in the failure of the insulation in a very short space of time, owing to absorption of moisture from the atmosphere. The good points are low capacity and cheapness. In this branch of cable manufacture great improvements have been made during the past few years. Three years ago the inductive capacity of such cables was .2 microfarad per mile. To-day they are being made with a capacity not exceeding .085 microfarad per mile; thus for telephon transmission two and a half miles of cable now have the same effect as one mile did three years ago. This great gain has been caused chiefly by doing away with the saturation of the covered conductors with paraffine or other insulating material. It has been found that the lead covering is rarely punctured, and that when such an accident does happen the cable can be easily and quickly repaired. The saturation of the insulating compound was intended to prevent the rapid inroads of moisture which it was feared would take place when the lead was perforated, if such hygroscopic materials as cotton and air were used alone, but it has been decided that the precaution is unnecessary. The cables are now made without any filling except at the ends and at the splices. The insulating cov-

ering is laid on loosely so as to keep the conductors a proper distance apart and at the same time have as much of the space in the pipe as possible filled with air. The result is a cable which has a very high insulation and a very low capacity, lower than has been obtained in any electric wire not strung in the air. As long as the lead pipe remains sound the insulation will be maintained; if the lead pipe is damaged and moisture or damp air allowed to penetrate to the conductors, the insulation will quickly fail and the cable become unworkable.

We see, then, that the telegraph and telephone engineers have to maintain a uniform insulation throughout a considerable length of line; the insulation need not have a very high resistance, because the currents employed not being of high potential the insulation is not subject to severe strain. In overhead wires the insulation is comparatively low (except in very cold, dry weather) because of the slight leakage which takes place at every insulator. In underground and submarine lines the insulation is much higher than that obtained with overhead wires, but it would be lower than it is were it possible to obtain a durable and uniform insulating material having a comparatively low resistance.

(*To be Continued*)

TELEPHONE ON SHIPBOARD.

Electrical appliances are used for a great variety of purposes on shipboard. In vessels built for the naval service, this is especially true. Few men-of-war are now constructed that are not electrically lighted and provided with projectors. In numbers of them electric motors are employed for different purposes. Many devices of an ingenious character have recently been utilized, such as that which causes an alarm to sound when the shaft bearings wear away to a dangerous extent. Fiske's electri-

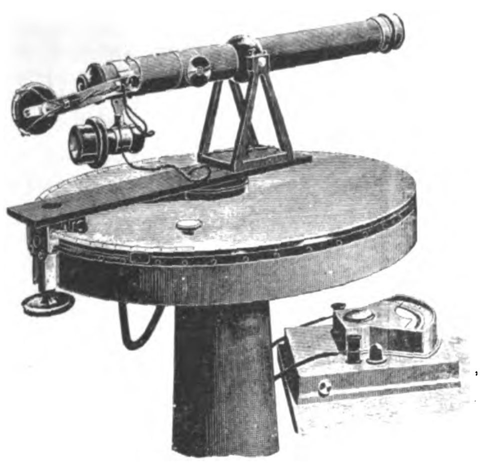


FIG. 1.

cal range finder has excited the interest of naval authorities throughout the world. It has been successfully fitted on war ships belonging to the United States, French and Italian navies. It is proposed here, however, to refer more particularly to means of communication on shipboard effected by the telephone.

Speaking tubes on shipboard are objectionable. Primarily, they are difficult to put in position, and they are easily damaged. A person using them frequently has to speak in loud tones, in order to make himself understood. The use of telephone, on the other hand, does not involve any of these objections, and it is rapidly coming into use. Reference has already been made to Fiske's range finder. The device has been so frequently described that only a brief reference is requisite here. It is employed to determine the distance of objects at which it is desired to fire a gun on shipboard. The range finder consists of a fairly powerful telescope mounted on a standard, which can be rotated round a vertical axis, corresponding with the centre of a large disk shown in Fig. 1. One-half of the edge of this disk is graduated to 90 degrees on either side of a zero point, and below the graduation is fixed a length of platinum silver wire. This wire only extends to a distance of 81.1 degrees on either side of zero, and is intended to form two arms of a Wheatstone bridge. The sliding contact is carried by the same arm as the telescope standards, so that it moves with the telescope. In practice two instruments are used, which are mounted at a known distance apart on the ship. If the two sectors are coupled up with a battery and a galvanometer, and the telescopes are parallel, the galvanometer will not indicate current. But as they are located at different points when they are pointed at the same object, the arms will be aligned in different directions. The Wheatstone bridge formed by these segments and their connections will be out of balance, and

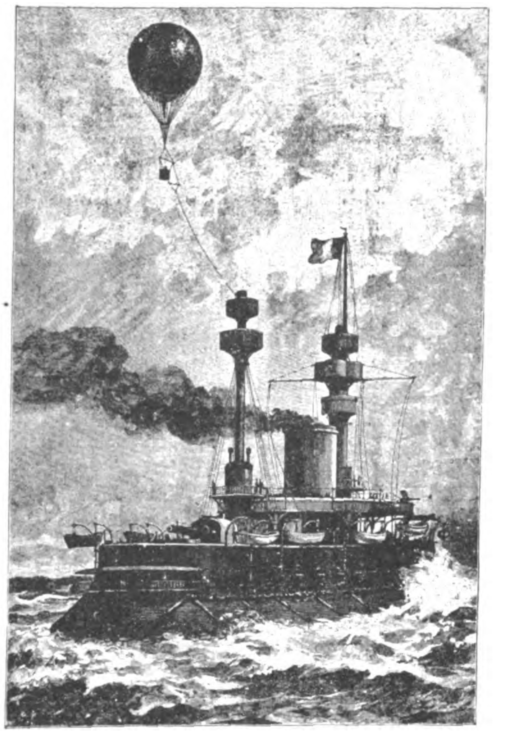


FIG. 2.

a current will flow through the galvanometer, which may be so graduated as to give the range by direct reading. As the illustration shows, the range finder is provided with a telephone so that the observers in charge of the instruments can readily converse and decide without difficulty on what point to align their telescopes.

An interesting use of the telephone in the naval service has also been made in connection with a balloon. The illustration tells the whole story. An officer ascends in the balloon, which reaches a height depending on the amount of cable paid out on the ship. From his high elevation the officer can make observations which would be impossible from the ship. He can keep in constant communication with the commander or officer in charge by means of a telephone.

A BOSTON SUGGESTION.

Boston is nothing if not æsthetic. For example, a Hub paper, speaking of the laying out of Huntington avenue, discourses as follows: "It is probable that, within a comparatively short time, electricity will take the place of horses for the street cars on Huntington avenue. The car tracks could then run through a bed of turf, bordered with trees, as on Beacon street. The change could be made with little difficulty, for it would simply be necessary to remove the loam and the turf now bordering the sidewalks to the center of the street. This would not necessitate the narrowing of the roadway in the least, for the space occupied by the sidewalk lawns would be thrown into the street. A most agreeable effect would thus be gained, and the separation of the car traffic from the carriage traffic would enable much more rapid time to be made by the electric cars, to the advantage of all concerned. The danger of accidents from the electric cars would also be greatly diminished, for a slight railing might guard the tracks so as to prevent persons from getting in the way of the cars, which would stop only at the street crossings."

DYNAMO ROOM OF THE PHILADELPHIA.

The trial trip of the Philadelphia revealed a number of faults in the cruiser. One of them was found in the dynamo room, but the fault was not with the electrical machinery. Incidentally the desirability of electrically-operated ventilating fans is shown in the following reference to a defect in the ship: Another serious defect in the ship's construction relates to the ventilation of her dynamo room. This room is fitted out with three dynamos which generate the electricity that supplies the four great search lights and the 471 incandescent lamps with which the ship is supplied. Originally the dynamo room was furnished with a fan whose function was to expel the heated air from the dynamo room into the neighboring engine room. It was supposed that cool air from the deck would take its place. But owing to some defect in the ventilating arrangements this did not prove to be the case. The air which took the place of the expelled air did not come from the outside at all, but only from the neighboring rooms, and this, as the electrical apparatus is situated deep in the bowels of the ship, was fetid and next to useless for breathing purposes. The consequence of this condition of affairs was that the temperature in the dynamo room frequently rose from 115 degrees to 130 degrees Fahrenheit, and the room became well-nigh uninhabitable. To remedy this defect two supplementary fans have been placed in the dynamo room to draw the fresh air directly from the deck. By these means a strong draft has been created through the room, which makes staying both in it and in the engine room more bearable than it formerly was.

CHANCE FOR A MOTOR.

On the sixth floor of an immense structure now building in Chicago are located a steam engine and crane which are used in hoisting materials to the points where they are needed. An electrical engineer, who was watching the operation a few days ago, relieved his mind by expressing himself in this strain: "There is an excellent opportunity for an electric motor thrown away. How much easier it would be to handle a motor than an engine up in the air. Think of the bother of taking water and coal up to that point. It would be far more convenient to run wires. The current could be obtained from a central station, or, if that would not be convenient, why not have a portable electric generating plant, something like that illustrated in ELECTRICITY a couple of weeks ago?"

FROM NEWS CENTERS.

NEW YORK.

NEW YORK, August 8. "Another victim has been claimed by the deadly electric current. Henry Bartels shocked to death by four hundred volts." This was the heading of a column which appeared in one of the dailies this week, in which the unfortunate death of a young bartender was described. The story told how the victim was discharging the duties of his calling when he chanced to touch a one-horse motor which ran the fans of the saloon. "He had one hand on a part of the motor and the other on an automatic corkscrew attached to the metal bar. He was standing on a mat of iron netting that is always soaked with water, and this would give him a ground connection. A crash was heard of breaking glass, and poor Bartels was seen clinging to the motor, writhing in agony, and going through all the horrible tortures of death by electricity. A groan escaped from his lips, the muscles were seen to contract, his features were contorted with pain, a shudder ran through his frame and then

he dropped to the floor behind the bar." Then followed details of "the fingers of both hands black and contracted like a lobster's claw," and various scars "that looked like burns from some hot metal." At the autopsy on the body of the deceased yesterday, Deputy Coroner Conway said he failed to discover any of the characteristic signs of death by electricity, and pronounced that death was caused by uremic convulsions. Dr. Jenkins, who assisted in the autopsy, coincided with Dr. Conway in believing that electricity had nothing whatever to do with the man's death. Although the public are becoming better informed on electrical subjects, it can hardly be expected that they can be delivered for some time to come from these graphic proofs that the daily reporter is but human, and finds it hard to withstand the temptation of ringing in the pet scapegoat of the day when it presents itself in such an irresistible guise.

Commissioner Gilroy has been taking the contractors for the construction of the cable trenches on the Third avenue road to task for the apparently reckless way in which they have set about to cause as much inconvenience as possible to the public by making openings in the streets without adequate means of completing the respective sections opened. Mr. Gilroy said he was informed that they did not propose to begin work between One Hundredth street and Fifty-ninth street in such time as would enable them to complete their contract till next year, and he insisted that not only should some of the openings already made be closed, but that the present force of workmen should be quadrupled in order that the work should be finished on time. There has been a great deal of delay at all stages of the work on this road, and the fact has been freely commented on. There are those who believe that it is attributable in part to the conviction in the minds of the company that the cable may not, after all, be the ideal system of traction for the streets of a crowded city, and that there have been shrewd reasons for the desultoriness of past operations, which at all events has given time for some of the results of experiments in electric traction for city streets now in progress to assert themselves. There has been so much ground for this belief that it is even now a question whether cable cars will ever run on Broadway. There is, however, no question that if they do come into active service on that line their operations are likely to extend over but a very short period. This result will probably be owing to two main causes; the unsuitability of the cable for the service, and the rapid maturing of an electric system of propulsion which can readily be adapted to the cable line, and which will be found much cheaper to operate and much more reliable and effective than the system which the company is now engaged, with such methodical want of method, in installing.

The station of the Richmond County Light, Heat and Power Company, Staten Island, was burned to the ground on Tuesday night. The company supplied 350 arcs and 600 incandescents in the streets and business places along the east and north shores, from South Beach to Mariner's Harbor, and Staten Islanders will have to fall back on gas and kerosene for some weeks to come. The damage is put at over $75,000, and the company was fully insured in the Electric Mutual, the Massachusetts Mutual and other companies. The fire started in a garret in which some old lumber was stored, and the whole roof was nearly consumed before the engineer, who was looking after the plant, knew anything about it. It is probable that this fire may teach some valuable lessons in the construction of future stations, and help to strengthen the conviction that is taking hold on electricians that if the safety of their plants is to be ensured they must be placed in buildings not only suitably designed, but absolutely fireproof, both in themselves and in their connections. The works are to be rebuilt at a point on the bay, so that condensing engines and ready access to coal will reduce the cost of operation.

It is understood that a Brooklyn electric railroad syndicate has completed negotiations for the purchase of the franchise of the Belt Line Street Railway, Staten Island, running from Fort Wadsworth to the New Brighton and Port Richmond line, and is prepared to begin work immediately.

As newspaper publishers generally are anxious to have the law in regard to the publication of news of electrical execution tested, District Attorney Nicoll has decided that a wholesale indictment and wholesale prosecutions will better carry out that end than the previously accepted plea of causing one newspaper to bear the brunt of the battle. Indictments have therefore been handed down by the Grand Jury against the representatives of the *Times*, the *Sun*, the *World*, the *Press*, the *Morning Journal*, the *Recorder* and the *Morning Advertiser*, for their reputed delinquency in regard to the publication of the accounts of the recent execution by electricity.

G. H. G.

BOSTON.

Boston, August 8. The Edison Illuminating Company, of Boston, is now supplying current for over 40,000 incandescent lamps, over 400 arc lamps and for motors of an aggregate of 2,200 horse power. It has 64 dynamos at work in its two stations, yet has found it necessary to purchase the old Liverpool wharf property, where it will soon erect a third central station on the harbor front. Quite a number of residents in the Back Bay district have had motors installed for running passenger elevators and the Edison company supplies current for all of these.

The town of Beverly, Mass., was illuminated by electricity for the first time last Wednesday night, causing great enthusiasm among the residents. The new station of the local gas and electric company was started up and two 50 arc lamp dynamos supplied current for the new circuit, which extends from Salem to Manchester and Wenham. The new station is a model one in every respect. It contains a 300 h.p. Green compound engine of the Cross pattern. Two incandescent dynamos are now being installed.

The Public Works Company is the title of the new consolidation of the electric light, gas, water and street railway companies of Bangor, Keazie, Orone and Old Town, Me.

News has been received in Boston that the Thomson-Houston Electric Co. has purchased a large interest in the Municipal Electric Light Co. in St. Louis, Mo.

A prominent electrician of this city a few days ago said that within a very few years nearly every telegraph and telephone wire will be placed underground; those left overhead would be the few that are necessarily changing all the time. This opinion is confirmed by many others. The Western Union Telegraph Company is about completing its southwestern division of underground conduits in this city, which has cost about $50,000 per mile. The wires throughout the northwestern section of the city have been underground for some years, so that in the course of a week or two at least 90 per cent. of all its lines in the city proper will be underground.

The New England Telephone & Telegraph Co. has opened up 17 miles of streets and laid about 6,000 miles of wire, owning now a very efficient system of underground construction which has cost not less than $64,000 per mile. Nearly all the wires owned by the Edison Illuminating Company in Boston are now underground.

The people of Weymouth, Mass., are getting quite worked up about the proposed electric street railway which is to connect the various parts of that wide-reaching town. If the directors don't bestir themselves ere long indications point to matters being made lively for them.

Bradford, Kyle & Co., manufacturers of insulated electrical wires, in the old historic town of Plymouth, Mass., are turning out large quantities of wire .002 inch in diameter, covered with a green silk insulation .00175 inch thick. It takes nearly sixteen miles of this wire to weigh a pound. The same firm is making an aluminum wire .006 inch diameter, insulated with white silk.

There is a little friction just now between the street lighting committee and the local electric light company at Middleborough, Mass., owing to inability to come to terms about street lighting. The last contract expired on July 31, whereupon the directors of the company submitted a proposition for the coming year. At the recent town meeting $3,500 was appropriated for lighting the streets. Now, however, many citizens are advocating a municipal lighting system, and the local company is claiming that it cannot afford to run its plant unless it holds the contract for street lighting. It will be interesting to know the outcome of this little difficulty. The people are in love with electric lights, but the municipal ownership fever appears to have seized them just now.

A good deal of hard feeling has been engendered among the employes of the West End Railway Co., Boston, by the issuance of a new time schedule which the men claim is equivalent to a reduction in wages. An increased number of trips per diem is arranged which is warmly opposed by the men. Meetings are being held and it looks as if an amicable settlement will soon be made.

W. S. K.

OMAHA.

Omaha, August 8. The American District Telegraph Company is installing the Frost automatic fire alarm system.

Work has been practically suspended on most of the new electric motor lines for this season, but is progressing rapidly on the new Thirteenth street line.

The Lincoln Electric Light Company secured the contract for the electric light plant in the State Normal School at Peru. The fight for the contract was an exciting one. Several Omaha firms sent in bids.

The new electric motor line to East Omaha has been completed and is working satisfactorily. In fact Omaha citizens are enthusiastic over electric railways.

It is said a new electric power house will be erected in Omaha. The only one now in the city is owned by the Thomson-Houston Company.

Work has been begun for wiring the new city hall. The structure is seven stories in height, and stands at the corner of Eighteenth and Farnam streets. It will take several months to complete the job, as it is one of the largest electric contracts let in Omaha for many a day.

The Street Railway Company is building a large addition to its Nicholas street power house.

Council Bluffs is building several new electric light towers.

Council Bluffs is increasing its electric railroad system. Only single cars are run owing to the many heavy grades.

It is said the Omaha Street Railway seriously contemplates substituting electric motors for the cable on the Dodge street road.

R. A. E.

INCORPORATIONS.

The following new companies have been incorporated:

Edison Electric Illuminating Company, Atlanta, Ga.; capital stock, $10,000; promoters, J. F. Dickinson, W. H. Rhett, W. H. Inman, Atlanta, Ga.

Highland Electric Light & Power Co., Highland, Ill.; capital stock, $8,000; promoters, Edw. Fentz, Henry Buchheim and Fred Siegrist.

Maryville Electric Light and Power Company, Maryville, Mo.; capital stock, $25,000; promoters, Wm. A. Ross, Maryville, Mo.; J. W. Smith, Maryville, Mo.; J. H. Tracy, St. Louis, Mo.

The Crescent Insulated Wire and Cable Company, Trenton, N. J.; capital stock, $50,000; promoters, Richard R. Whitehead, C. Edw. Murray, and Harry T. Solliday, all of Trenton, N. J.

Continental Development Company, Richmond, Va.; capital stock, $800,000; machinery and electric equipments and general manufacture, real estate and improvements; promoters, L. Lamb, T. A. Lamb, J. E. Tarpin, J. H. Harvey, A. H. Felthaus.

Brenham Compress Oil & Mfg. Co., Brenham, Washington Co., Tex.; capital stock, $150,000; ginning, baling and compressing cotton, manufacturers cotton seed oil, operate electric plants, etc.; promoters, D. C. Giddings, Wm. Perry, Thos. Dwyer.

Steubenville Railway and Electric Company, (Incorporated in W. Va.) Steubenville, Ohio; capital stock $100,000; to operate an electric railway in Steubenville, Ohio; also to supply light and heat; promoters, B. B. Gawthorp, C. C. Hughes, Pittsburgh, Pa.; Donald B. Toucey, New York City, N. Y.

Penn Yan Electric Light & Power Co., Penn Yan, N. Y.; capital stock, $100,000; promoters, Henry Q. Stimpson, Boston, Mass.; Henry Russell, Albany, N. Y.; Calvin Russell, Jr., Penn Yan, N. Y.; J. T. Birkett, Penn Yan, N. Y.; Howard L. Woodruff, Penn Yan, N. Y.; W. S. Bruen, Penn Yan, N. Y.

LIGHT.

The Minneapolis Exposition Building will be lighted by 150 arc lamps and 1000 incandescent lamps.

A Marquette, Mich., paper says the Gas & Electric Light Company has decided to install an arc and incandescent plant at once.

It is said that the Chippewa Falls Milling & Elevator Company will install an electric light plant in Chippewa Falls, Wis.

The Iowa Investment Company has purchased the Climax Electric Light company, of Iowa City, Ia. The company will, it is said, introduce an electric railway in the city.

The Frackville, Pa., Electric Light, Heat & Power Company has awarded to the Thomson-Houston company the contract for equipping its plant.

The municipal electric light station at Coldwater, Mich., will be in operation about October 1st. Crude oil will be used as fuel.

A franchise has been given to the New Merchants Electric Light Co., of Leavenworth, Kan. It is provided that within 180 days the company must have at least one circuit in operation and a plant capable of supplying 75 arc lights.

A legal obstacle has prevented the town of Leslie, Mich., from securing electric lights. The injunction has been vacated,, and last week the citizens celebrated the event by bell ringing, band playing, bonfires and a parade.

POWER.

The Olean, N. Y. street railway will be converted into an electric road.

Employes of the Davenport Electric Railway will form a union, according to a local paper.

The total coinage issued at the United States mint during the month of July was 9,009,000 pieces of all kinds. The machinery for coining about one-third of this number was operated by an Eddy electric motor.

A charter has been issued to the Gettysburg Electric Railway company, capital stock $100,000. The road will be four miles long, and will render the famous battle field easier of access to visitors.

A project for transmitting the power of the San Joaquin river to Fresno, Cal., is under consideration in that city. The local papers state that sufficient power could be utilized to operate all the mills in the city, furnish the lights, and supply the several adjoining towns with illumination.

It has been insinuated that the Chicago & Jefferson Urban Transit Company, which was formed to build an electric railway west and north of the intersection of Canal and Monroe streets, was considering an offer to sell its state charter to an existing company. The officers of the company deny the report.

It is stated another electric railway is under consideration in Chicago. This time it is proposed to lay tracks to Hawthorne. It is understood, however, that the line will be built to connect with the Ogden avenue cars or run across West Forty-eighth street to the Austin electric road, which now has a terminus at West Fortieth and Madison streets, where it connects with the Madison street cable line.

San Francisco and San Mateo, which are twenty miles apart, are to be connected by an electric railway. A local paper says: "The opening of this new road is of particular interest from the fact that it is the inauguration in California of a system of railroads that are to be operated by electric power, and it is prophesied that at no distant day there will be long lines of such roads introduced in the interior of the state."

Superintendent Divine, of the Electric Railway Co. of Chattanooga, Tenn., has been inspecting roads in several cities. He thinks that the rate of speed at which cars travel in St. Louis is dangerous. This is his general conclusion: "Several things came to my notice that convinced me that Chattanooga not only has as well equipped and managed electric system of street railroads as any city of its size in the country, but that it has the best looking best dressed, the most intelligent and accommodating motormen and conductors I have ever seen on any road."

A correspondent sends the following to ELECTRICITY: Fairhaven, a thriving young city on Bellingham bay in the state of Washington, will have a mile and a half of electric street railway in operation by Sept. 1st, This line will run in connection with the line already in operation through the towns of Whatcom and New Whatcom and when completed will form a line about 4 miles long encircling Bellingham bay and affording one of the most delightful street car rides in the world as the line overlooks the bay practically at every point. The mile and a half is but a forerunner of a large amount of work to be done in Fairhaven the next year as the company has 23 miles of franchise. The Thomson-Houston system will be used. F. C. Todd is doing the work.

Thomas Lowry has just been interviewed in regard to the electric railway systems of St. Paul and Minneapolis. Here is what he says: "These two great cities require a great service, and that is just exactly why they got it. I cannot give you the exact figures, but the great improvements in St. Paul and Minneapolis during the past fifteen months cost, in round numbers, $6,000,000. That looks like an almost incredible statement, perhaps, but the books show for it. Long ago, when we first decided upon the new system, we employed some of the best engineers in the country, and they went to work figuring out estimates. It then looked as if the company would have to expend something between $2,000,000 and $2,300,000. But here is where we experienced a gigantic surprise. Of course, the changes which we made from the original plans were numerous and cost a great additional outlay. Things were largely in an experimental stage. As we progressed with the work our eyes were opened. We learned something important almost every day. We got more actual knowledge about all the things which entered into the make-up of such a system during the initiatory operations than we had secured by months of preliminary guesses and calculations. We now have in the two cities between 225 and 230 miles of electric railway. This is about evenly divided between the two cities."

JOTTINGS.

The Van Gestel Lamp Company has been formed in Denver to manufacture the Van Gestel incandescent lamp.

The *Telegrapher*, the official organ of the brotherhood of telegraphers, has been removed from Chicago to Fort Wayne.

A three hundred light alternator with converters has been ordered for Prof. Carhart's department at the University of Michigan, Ann Arbor.

The first Card electric mining machine was recently tested at the factory of the Fort Wayne Electric company, Fort Wayne, Ind. It is said that the machine works admirably. The inventor, George F. Card, has charge of the mining department of the Fort Wayne Electric Company.

Aldermen Roth, Woodard, Powers, Eisfeldt, Mahoney, D. R. O'Brien, Dvorak, Madden, Gahan, O'Neill, McGillen, Kerr, Gorton, Kent, Bidwill and Commissioner Aldrich, of Chicago, have started east on a tour of inspection. They intend to visit all the eastern cities having elevated tracks. Their object, among other things, is to inspect the different methods of propulsion in use on surface and elevated car tracks.

An English paper says the Wolverhampton Chamber of Commerce has received a communication from the postmaster-general, stating that the government do not contemplate immediately taking over the undertakings of the telephonic companies, but are prepared to establish telephonic exchanges in centers where required, and that the whole question of telephonic communication is still under consideration by the department.

The structure at the northwest corner of Sixth and Wyandotte streets, Kansas City, will hereafter be known as the Telephone Building. The general offices of the Missouri & Kansas Telephone company have already been removed there, but the operating room will remain in the present building for a twelfth month. The company has 2 600 instruments in use in the city. When the change is made the service will not be discontinued over five minutes, according to Manager W. W. Smith.

PERSONAL NOTES.

E. Baggot of Chicago, has just returned from a business trip to New York.

George M. Meyers has been appointed receiver of the Jasper County Electrical Power Company, of Webb City, Ia.

S. W. Childs, who has superintended the line construction for the Lincoln, Neb., street railway system, was in Chicago last week,

Ex-Governer A. C. Hunt, president of the Laredo Electric Light Company, is dangerously sick at the Sherman House, Chicago. He is suffering from a stroke of paralysis.

W. S. Andrews of the Edison General Electric Company, of New York, was in Chicago Monday. He has been inspecting Edison stations and he makes a very favorable report concerning them. He left in the evening for New York to attend the convention of Edison companies.

By the death of Mr. Willoughby Smith, which occurred in London late last month, the telegraph engineers lose one of their best known veterans. Mr. Smith was associated with submarine telegraphy from its very inception as a commercial undertaking and has occupied the position of chief electrician of the Telegraph Construction and Maintenance Company which was organized to lay the successful Atlantic cable of 1866 from the formation of the company up to a year or two ago. He introduced many improvements in submarine cables, in the instruments for working and in methods of testing and signaling. By a discovery he made affecting the process of preparing gutta percha he increased the speed of signaling by about 20 per cent. By a curious coincidence Mr. Smith's death follows closely upon that of Mr. Brooks, one of the veteran telegraph engineers in this country.

COMMERCIAL PARAGRAPHS.

Charles L. Ireson, manufacturer of solid and link belts, 97 High St., Boston, reports business excellent. He has more orders on hand than he can keep pace with.

The Mason Regulator Co., Central st., Boston, continues to ship regulators in large numbers. Some of the leading railways in this country are to-day using scores of them.

The Gloucester, Mass., Electric Light Co. has placed with Messrs. J. A. Grant & Co., of Boston, an order for two tandem compound McIntosh & Seymour engines of 250 h.p. each.

A large consignment of Paiste switch sockets has been received by the western branch, 341 Rookery, Chicago. These sockets are meeting with a great demand and they deserve their popularity.

The Eastern Electric Cable Co., of Boston, has just received an order for nearly 300,000 feet of "Clark" of one single size, for underground telegraph purposes. This, with many other substantial orders, keeps the company running night and day.

Wm. Hood, representing the Accumulator Company, whose business office is located at 239 La Salle street, Chicago, makes also a specialty of electric lamps and electric fans. He claims the latter and hot weather work well together for his business.

The consolidation of several large supply houses in the east, which caused much talk a week or two ago, is off so far as the Pettingell-Andrews Co., of Boston, is concerned. That prosperous company was never doing a bigger run of business than now and prefers to go alone.

The Economic Electric Mfg. Co., Boston and Brockton, Mass., is now fairly under way in the manufacture of incandescent lamps and is enjoying quite a boom. Its manufacturing facilities, which are quite extensive, are taxed to the utmost in supplying the steadily increasing demand.

The Hay-Horn Manufacturing Co., Chicago, has lately received large orders for the "Hay Bell," one of them being for 5,000 to be shipped to the Pacific coast. The company is soon to place a new annunciator on the market which will be noted for its simplicity and few working parts.

One hundred or more of the Partrick & Carter Co.'s new King annunciators will be used by E. T. Orne, 112 Randolph street, Chicago, in the new *Herald* building in that city, which he is now fitting with his electric speaking tube system. The demand for the King annunciator is extremely active.

The firm of Sargent & Lundy, of Chicago, which was formed June first, reports a number of recent orders in their line which is steam, electric light plants and electric street railways. They are now constructing the Grant Park Electric Railroad, at Atlanta, Ga. They make a specialty of the McIntosh & Seymour engines.

G. E. Cabot, of the Holtzer-Cabot Electric Co., 92 Franklin street, Boston, started on Friday for a month's much needed vacation, which he will devote to hunting, fishing, shooting and boating in the mountains. During Mr. C. W. Holtzer's absence in Europe, Mr. Cabot has had entire charge of the company's big business, which has included the transferring of the headquarters of the company to more commodious quarters.

The New England Phonograph Company, Boston, under the enterprising management of Col. Sansom, is rapidly increasing its volume of business. The exhibition department is kept quite busy, while the commercial department which places the phonograph in business offices, is having all it can do. Gentlemen in business have learned to appreciate the value of this very useful auxiliary.

W. P. Mullen, vice president and eastern manager of the Shultz Belting Co., St. Louis, Mo., reports big business for the past month. The demand for leather woven link belts of the Shultz type is gaining rapidly and nothing but good reports are heard of them. In electric light and power stations they are especial favorites, hence the good orders which are being received from all parts of the country and even from abroad. This firm is doing quite a business with Europe.

The handsome and well-made wooden box bells for 40 cents each, a specialty with the Eastern Electric Supply Co., of Boston, are being shipped in large quantities almost daily. This prosperous company is doing quite a live business in Card motors, the last one installed being of 15 h.p. to run the machinery in a factory covering six floors. The Eastern Electric Supply Co. has a contract for all the material for equipping the new electric street railway at Lawrence, Mass.

Messrs. Howard Bros., 63 Oliver st., Boston, New England agents for the C. & C. Electric Motor Co., continue to install their specialties in and around Boston at as brisk a rate as ever. During the present summer they have equipped a large number of buildings with motors and fans, while for elevator work they have just installed a 7½ h.p. and a 5 h. p. motor; also a 10 h.p. motor for running the printing presses in the establishment of the Morning Star Publishing Co., Boston.

S. M. Stevens was a visitor in Chicago this week. He is largely interested in the Western Electric Storage Battery Company, of Kansas City, Mo., and is just returning from a business trip to Lowell, Mass., where the eastern factory of the Bradbury Storage Battery Company is located. Mr. Stevens has recently been appointed superintendent of construction for the company at Kansas City and has been looking closely into the merits of this storage battery. He expresses himself as entirely satisfied with the results of his eastern investigation, and states that the manufacture of batteries will be commenced at Kansas City at once to supply the western territory which that company controls.

George Cutter, Chicago, has just returned from a trip through the Michigan mining districts, where he has been studying the special requirements for electric lighting in mines. Several of his experts are already at work on new designs of sockets and cut-outs which will resist the action of water, metallic salts, mine gases and the fumes from the powder. These are present to such an extent in most mines that they render the ordinary devices useless, and Mr. Cutter's new articles, together with his new mine switch, which has already proved a success, will fill a decided want. Extra heavy Simplex wire is used largely in such places and is giving satisfaction to Mr. Cutter the agent.

F. E. Degenhardt, Chicago, representing the Standard Underground Cable Company, received congratulations all last week, and is, in fact, still receiving them. His capture of the contract for the underground wires for the Brush Company's underground work in Minneapolis caused these felicitations. As the contract will amount to something like $100,000, and as the competition was more than brisk Mr. Degenhardt certainly scored a victory which his rivals thoroughly appreciated. They were among the first to extend their congratulations after the fight was over. In telling a story and in selling wire Mr. Degenhardt has few superiors in the business.

The Hall Signal Company is making several important improvements in its railway signal service.

The Simplex Electrical Co., of Boston, reports its last month's business as being extremely large. Dr. A. F. Mason, the general manager, is kept busy early and late, handling the details of this prosperous company, which he has worked up to so prominent a position in the electric wire field.

C. E. Bibber, general manager of the Consolidated Electric Manufacturing Co., Boston, continues to increase the output from the factory, 355 Congress street, Boston. The C. E. M. socket for incandescent lamps is now being made in immense quantities, the trade having promptly recognized its striking merits.

Timothy W. Sprague, of the Thomson-Houston Electric Co.'s mining department, has just returned to the Hub after quite a trip down South, where he found business in his line lively, but where he stayed long enough to leave it livelier. Mr. Sprague impressed upon a good many Southerners the advantages of electrical mining apparatus and did profitable work for his company.

L. W. Burnham, general manager of the Electric Gas Lighting Co., 195 Devonshire street, Boston, having traveled 12,000 miles since last February, and having transacted an immense amount of business at home, begins to feel the need of a summer vacation. When speaking about it, however, a day or two ago, he said: "I don't dare to think of going away. This Samson battery demand is lively enough to keep me hard at work."

The Tripp Manufacturing Co. is engaged in the construction of two electric motor trucks which will include some very unique points of efficiency, especially in the adjustment of the wheels on the journals of the shaft or axle. This company's anti-friction bearings will be used and unusual results are looked for. To enable it to handle its increasing business with promptness, the company is erecting a new factory 240 feet by 60 feet at South Framingham, Mass., an important railway centre, twenty-one miles from Boston. This building is to be complete and ready for use by October 1, next.

Whitmore & Robinson, electrical engineers, Ludlow Building, 135 Essex street, Boston, are two gentlemen of wide and varied experience in the electrical field, who have gone into business as consulting engineers, and are meeting with encouraging success. They make a specialty of testing, calibrating and reporting upon electrical instruments, devices and apparatus, and having been identified for over seven years, in a practical way, with one or two of the leading corporations, they are able to give their clients the benefit of their practical knowledge. They are doing a remarkably good business.

William F. M. Goss, professor of experimental engineering in Purdue University, has written to the Stratton Separator Company, 32 Cortlandt street, New York, as follows: "We have been using, for about a year, one of your 4-inch separators in connection with the compound engine in our engineering laboratory. Steam for this engine is supplied by boilers located 580 feet away, and notwithstanding the long length of pipe through which it is thus required to pass, it was never found, *by repeated calorimeter tests*, to contain as much as 3 per cent. of moisture when it passes out of the separator, regardless of the amount of water previously held by the steam."

The Western Electric Co., of Chicago, has just issued a general catalogue. It is a volume of over 300 pages. It is handsomely bound, well printed and profusely illustrated with excellent cuts of all the apparatus and devices manufactured and handled by the company. The general arrangement of the illustrations and reading matter is admirable, and indicates that those who had the work in charge thoroughly understand the art of book publication. The fact that seven pages are devoted to an index shows the comprehensive character of the volume. There is a great deal of matter of interest in the book altogether apart from the commercial side. Information of value, and reference tables are included in the book. It is a volume that will be kept by those to whom it is sent, as a work of reference that is likely to be of value at almost any time.

A most interesting announcement is contained in the appended notice: "I beg to announce the formation of a new corporation under the title of H. Ward Leonard & Co., whose principal office will be in New York City, and whose business will be that of electrical engineering generally, with special attention paid to electrical motor appliances, the transmission of power, the installation of central station lighting and power plants, the concealed wiring of large office buildings, hotels, etc., and plants in which advantages can be obtained by a combination of apparatus of various companies, such as alternating current systems, storage batteries, arc lights, etc. A feature of the business of this concern, which is entirely novel, will be the supplying of expert information regarding engineering matters, the operation of different plants and upon the best methods and system of accounts in connection with the operation of electrical plants. Such information will be supplied by correspondence at a very moderate charge per annum. This company will be actively in business before September 1. Their offices will probably be in the Columbia building, 29 Broadway, New York City." No electrical engineer in the field is more widely known than H. Ward Leonard, and in his new enterprise he will have the heartiest support.

ELECTRICAL PATENT RECORD.

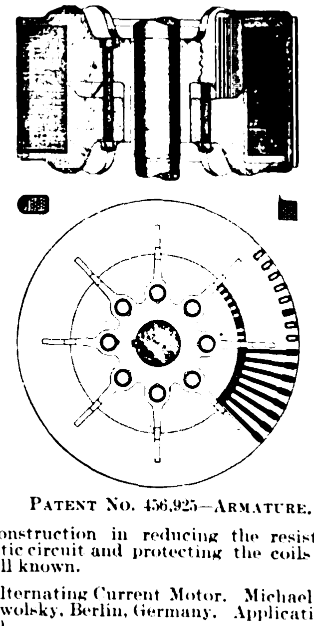
LETTERS PATENT ISSUED JULY 28, 1891.

DYNAMOS AND MOTORS.

456,593. Regulation of Dynamos Driven by Compressed Air. Victor Popp, Paris, France. Application filed April 7, 1888.
This invention relates to a method of operating dynamo-electric machines from a system of compressed air distribution; and it consists in an arrangement by which a common regulation of the dynamo and its driving engine is effected. It also consists in a device for cooling the dynamo by means of the exhaust air from the engine.

456,908. Electric Hoisting Machine. George H. Reynolds, New York, N. Y. Application filed Dec. 27, 1890.
This invention relates to an improvement in hoisting machines. The improved machine is adapted for operating by an electric motor and is controlled by introducing a greater or less resistance in the electric current which drives the motor. The improved machine provides convenient means for varying the amount of resistance at will between wide limits.

456,925. Armature for Motors and Generators. Norman C. Bassett, Lynn, Mass. Application filed Feb. 27, 1891.
This invention relates to improvements in iron clad armatures in which the armature coils, instead of passing over the periphery of the armature core, are passed through perforations near the periphery so as to allow the iron of the core to extend between and around the coils and form an iron periphery. The advantages of



PATENT NO. 456,925—ARMATURE.

this construction in reducing the resistance of the magnetic circuit and protecting the coils from injury are well known.

456,804. Alternating Current Motor. Michael Von Dolivo Dobrowolsky, Berlin, Germany. Application filed Dec. 23, 1890.
This invention relates to such electric motors as are driven by a plurality of alternating currents of respectively different phases. As is well known, motion is produced in the said motors in this manner: that the alternating currents are caused to generate in a body of iron constituting a field magnet, magnetic poles which continuously alter their position, and that an armature placed movably under the influence of the said poles is forced by the latter to partake of their motion. The improvement forming the subject of this invention consists in the particular arrangement and combination, with the motor, of the conductors serving to receive the operating currents.

CABLES AND INSULATORS.

456,574. Span Wire Insulator. Walter S. Jarboe, William P. Seibert and John White, Allegheny, Pa. Application filed Nov. 28, 1890.
This invention relates to what are commonly known as "span wire insulators," that is, to a form of insulator employed to insulate the span wire, from which the trolley wire is suspended in the overhead system of electric railways. The object of this invention, therefore, is to provide a cheap, yet durable insulating block free from any joints or openings to which water or frost might find access, and one in which the connection for the support of the depending link is rigidly secured within the body of the block without the employment of a threaded connection of any kind.

456,600. Span Wire Insulator. William P. Seibert, Allegheny, Pa. Application filed Dec. 13, 1890.

456,611. Cable Head for Electric Wires. Upton H. Balsley, Philadelphia, Pa. Application filed Jan. 12, 1891.
This invention relates to an improvement to the head fitted to the end of the cable whereby the end of the cable is properly sealed and yet ready access may be had at all times to the end of the conductors of said cables.

ELECTRIC RAILWAYS.

456,683. Attachment for Poles for Electric Wires. Edmund Verstraete, St. Louis, Mo. Application filed July 7, 1890.

MINING.

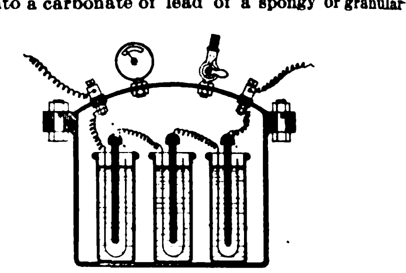
456,622. Magnetic Separator. David E. Lane, Yonkers, N. Y. Application filed August 2, 1890.
This invention relates to an improvement in the form of magnet separator and contains such an arrangement of parts that the material to be separated is subjected to the action of gravity and of a centrifugal force variable in amount, which tends to remove the material from an apron or barrel on which it is carried, while the magnetic lines of force from a battery of magnets inside the barrel tend to hold the magnetic part of the material against the barrel.

LAMPS.

456,598. Electric Arc Lamp. Francois L. Sautter, Paris, France. Application filed Dec. 18, 1890.
The invention relates especially to the automatic maintenance of the luminous point in the focus of the apparatus in which the lamp is placed, whether a lighthouse, a projector or any other.

BATTERIES.

456,558. Electrode for Secondary Batteries. Otis C. Flick, Brooklyn, N. Y. Application filed Jan. 3, 1887.
Claim I. describes a method of making electrodes for secondary batteries consisting in casting or placing pure metallic lead into apertures, cavities or recesses or upon the surface of a plate composed of a metal or alloy that is not affected injuriously by the exciting liquid of the battery, then converting the pure metallic lead into a carbonate of lead of a spongy or granular



PATENT NO. 456,843—SECONDARY BATTERY.

nature while held in the cavities or apertures or upon the surface of the plate.

456,834. Secondary Battery. Henry Pieper, Liege, Belgium. Application filed Feb. 10, 1888.
The purpose of this invention is to increase the capacity and efficiency of the electrolytic system, and this is effected by artificially increasing the opposing initial resistance to the chemical decompositions by means of which the work is to be stored up.

MISCELLANEOUS.

456,612. Electromotive Force Regulator. Edward M. Bentley, Boston, Mass. Application filed Oct. 21, 1890.
Claim I. describes a method of regulating electric generators or motors which consists in dividing them into two sources of electromotive force and completing the circuit of each source through a variable portion of the other source.

456,667. Spout Alarm for Grain Bins. Walter G. Adams, Racine, Wis. Application filed Dec. 3, 1889.
This invention consists in applying a valve to the spout which is turned by the flow of grain through the spout but closes automatically when the stream of grain ceases, thereby sending off an alarm either when the discharge through the spout is stopped, or when it begins, according to the circumstances of the case.

456,673. Coin Controlled Photograph Apparatus. Frank Martin, Newark, N. J. Application filed April 8, 1891.

456,684. Electric Gas Lighter. Adolph Wunderlich, Cleveland, O. Application filed April 7, 1890.

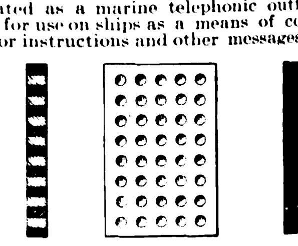
456,685. Automatic Electric Gas Lighter. Adolph Wunderlich, Cleveland, O. Application filed Dec. 5, 1890.

456,718. Coin Controlled Electrical Apparatus. Theodore L. Brooks, Port Byron, N. Y. Application filed Jan. 28, 1891.

456,746. Medical Induction Coil. Henry A. Voelkner, Detroit, Mich. Application filed Jan. 28, 1891.

456,805. Annunciator. William C. Dillman, Brooklyn, assignor to Owen Walsh, New York, N. Y. Application filed May 6, 1891.
This invention relates to improvements in that class of annunciators which are used in connection with speaking tubes. These speaking tubes are usually arranged in a building so that the tubes connecting with the various rooms will all center at a common point, usually the office, and in case a party in a distant room desires to speak with the office below it is necessary to give some kind of a call and to indicate which tube is to be used. The object of the invention is to produce a simple electrical device which will operate positively and which will clearly indicate the tube to be used.

456,817. Electric Circuit Changing Apparatus. Hammond V. Hayes, Boston, Mass. Application filed Feb. 3, 1891.
This invention describes the apparatus as a whole designated as a marine telephonic outfit, and is intended for use on ships as a means of communicating orders or instructions and other messages between the



PATENT NO. 456,558—ELECTRODE FOR SECONDARY BATTERIES.

bridge and other parts of the ship. It is of course not restricted to such use, but is of such a character and construction as to be conveniently employed under varying circumstances and conditions.

456,827. Clutch. William H. Johnson, Brooklyn, N. Y. Application filed April 1, 1891.

456,835. Electric Condenser Regulator. James McBride, Brooklyn, N. Y. Application filed Sept. 24, 1890.
This invention has reference to apparatus for automatically controlling the supply of cold water to condensers in accordance with the quantity or pressure of the vapor which is condensed, the object being to obviate waste water, to secure a uniform vacuum and to insure that the quantity of water supplied to the condenser is always proportional to the quantity of heat or the pressure going to the condenser.

456,859. Electric Light Crane. Charles H. Shank, Armourdale, Kan. Application filed Jan. 10, 1891.

456,865. Show Stand. John W. Tyler, Dayton, O. Application filed March 12, 1891.

456,888. System of Electrical Distribution. Morris Feilbogen, New York, N. Y. Application filed Sept. 22, 1890.
This invention relates to an improved system of electric distribution and it has for its objects to provide for interrupting the current of a constant electric generator or dynamo electric machine generating a constant current, so as to give the proper impulses to an inductorium or a series of such devices to generate a secondary current to be employed in an electric light or working circuit or series of such circuits.

456,889. Electric Circuit Breaker for Secondary Generators. Morris Feilbogen, New York, N. Y. Application filed Sept. 22, 1890.

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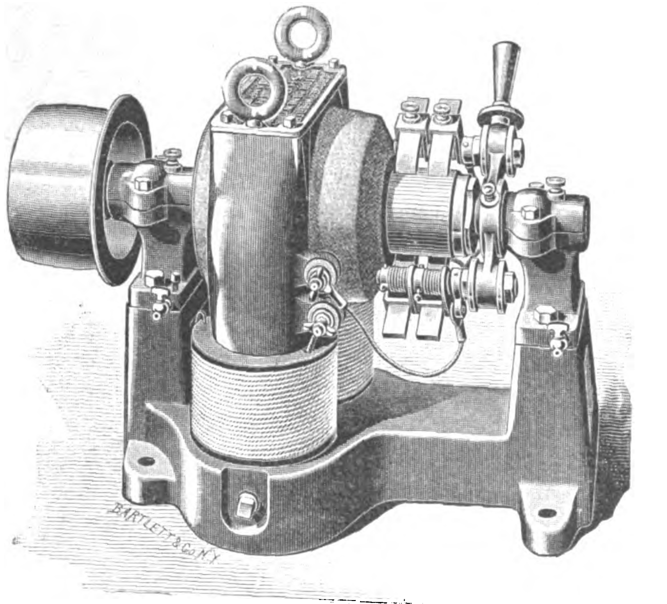
Electricity



ELECTRICITY.

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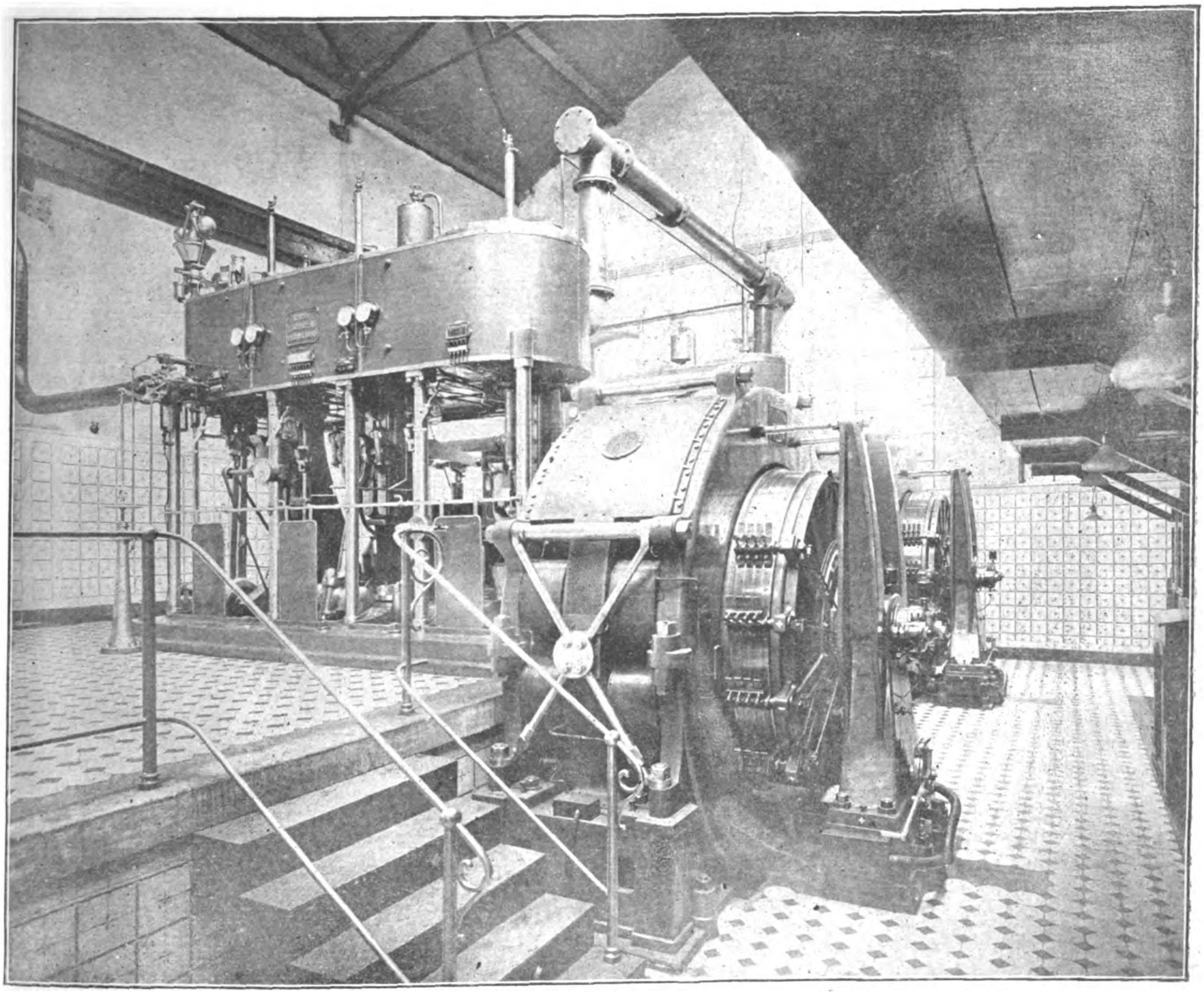


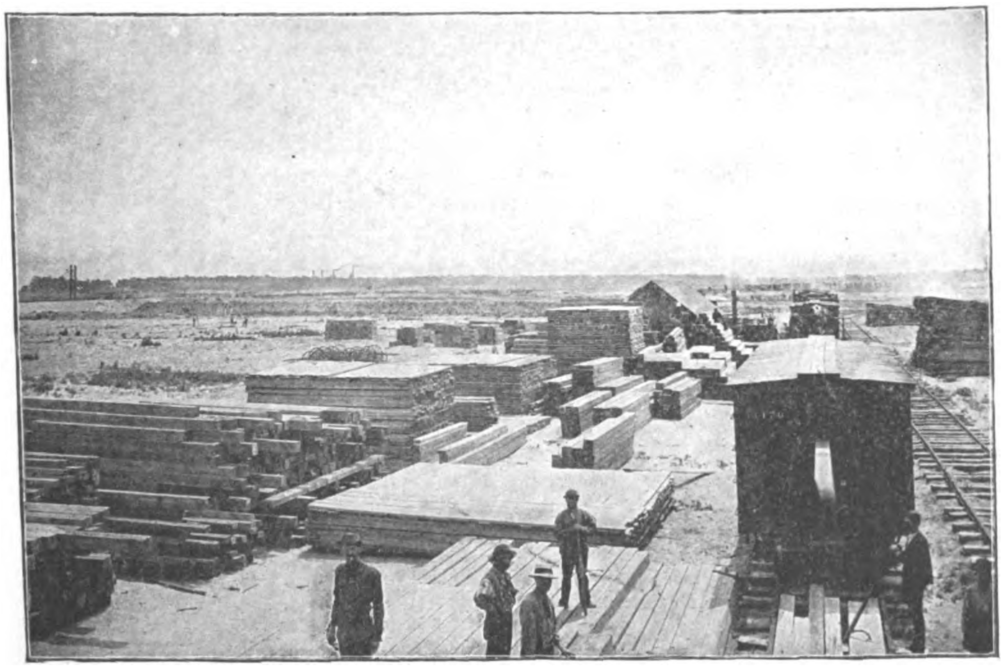
MUNICIPAL ELECTRIC LIGHT STATION AT HANOVER, GERMANY.

(See page 54.)

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The view which is shown herewith is negatively interesting. It indicates how little work has been done on the electricity building of the World's Fair. The cut is a reproduction of a photograph taken in the World's Fair inclosure within the last two weeks. It shows that at that time but little had been accomplished on the building which is to contain, perhaps, the most interesting exhibit of the Exposition. Since that time most of the timbers for the flooring have been laid. Work on the structures at Jackson Park was stopped by Chief of Construction Burnham last week, the electricity building among the number. This act rather dismayed those interested in the Fair. His action was stated to be the result of a desire to make tests to ascertain whether the plans provided for sufficiently strong buildings. Building was resumed within a day or two. It is to be hoped that no more delays of this kind will be found necessary. There is an enormous amount of work to be done in the electrical department alone, and every delay must interfere with the plans of those in charge of the work of the section. For the cut we are indebted to the publishers of the *Graphic*, Chicago.

The following estimate has recently been published in regard to the power to be used at the Columbian Exposition grounds: South of machinery hall and opposite the centre of the building will be located the boiler-house supplying the steam used in the building. This plant will be a model, and will have a capacity of 8,000 horse power. Only in machinery hall will steam power be used. Electric power will be used in all of the other buildings and will be transmitted by wires from the central electric plant. It is estimated that in machinery hall and its annex there will be above three and one-half miles of shafting. It is not yet determined whether crude petroleum or coal will be used for fuel. To run this big plant during the Exposition will require at least 75,000 tons of coal, or 225,000 barrels of crude petroleum. It will require at least 250 engineers, firemen and attendants to man this plant. To keep it bright and clean during the Exposition will require 90,000 pounds of waste, and it is estimated that 89,000 worth of lubricating oil will be poured on its innumerable bearings. This arrangement of the power plant for the Exposition is proposed by the construction department, and it is not probable that the arrangement will be materially changed.



Site of the Electrical Building at the World's Fair Grounds.

ELECTRIC WELDING.

Since the introduction of the electrical welding process many applications have been found for it in almost every branch of metal manufacture where the joining of separate portions of metal forms an important part of the daily work. Numerous examples of interesting and ingenious operations, carried out by means of electric welding, were cited by F. A. C. Perrine in a paper on the subject read a short time ago before the American Institute of Electrical Engineers. The welding of steel rails is accomplished satisfactorily by electricity, whereas good results were never obtained by hand welding. In the manufacture of agricultural machinery, iron wheels are made up by electric welding, the spokes being welded to the hub by one machine and then welded to the tire by another.

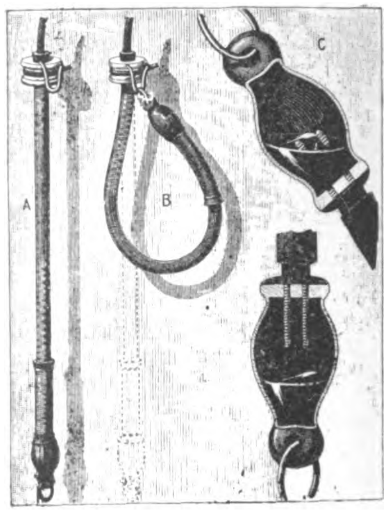
Probably the most ingenious and economical application of electric welding so far recorded has been made by a well known firm in Indianapolis which manufactures steel saws. Besides the regular work of making the joint in continuous band saws, the engineers of this firm have ingeniously applied the electric welder to replacing broken teeth in finished saws. Without the aid of the electric current it would be necessary to cut to a smaller size a saw with one or two broken teeth, and this was the course always followed previously to the introduction of electric welding. The loss involved was not only the difference in price between the two saws, but also the entire cost of labor in cutting the original saw. At present, when a tooth is broken out, a new one is fitted, which is electrically welded in place, and a drop of oil applied at the proper time, restores the temper to a serviceable point. The value of electricity in human dentistry will not be questioned, and in saw dentistry it manifestly performs a unique service.

ELECTRICAL AFFAIRS IN ITALY.

Electrical affairs in Italy cannot be in a very advanced stage. At the annual meeting of the Edison & Swan United Electric Light Company, held in London last month, the chairman, among other things, said: "We had a lot of dynamos which were quite useless to us, but we managed to sell them in Italy; we got rid of them the other day." Just before, the chairman said that these dynamos were effete machines that were taken over at the amalgamation of the two companies. It will be a matter of curiosity to know how the Italian purchasers get along with them.

MERCURY CONTACT.

It is easy to imagine circumstances in which such a circuit-closing device as that shown in the cut might prove extremely useful. It consists of a flexible rubber tube, at one end of which is a hard rubber bulb partially filled with mercury. The other end is attached to the wall by an insulator. Within the tube are the two conductors, which terminate in the bulb as shown at *D*. When the tube is in the position shown in *A* the circuit

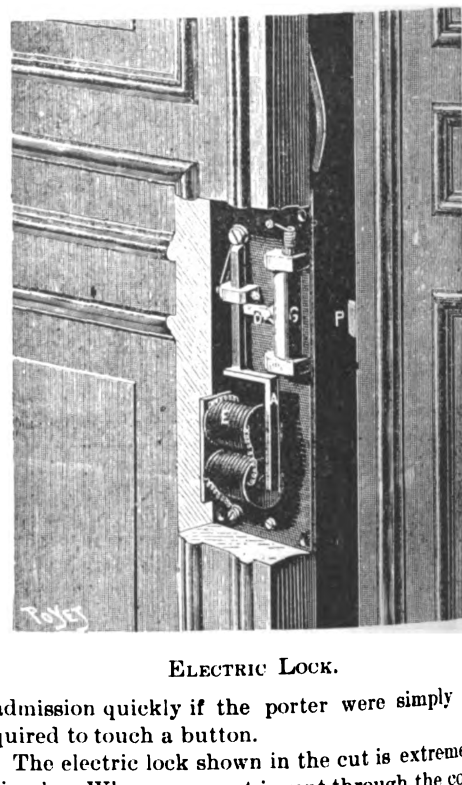


Mercury Contact.

is open, the mercury being in the position indicated at *D*. To close the circuit the tube is hooked up to the insulator as shown at *B*, and the contact is established by the mercury as represented at *C*. The cut is reproduced from *La Nature*.

ELECTRIC LOCK.

To unlock a door by merely pressing a button is an advantage under certain circumstances. Such a device is especially desirable on the other side of the Atlantic where some small hotels are closed at 10:30 p. m. The porter retires, and the belated guest must arouse him before he can gain an entrance. He would be much more likely to secure



Electric Lock.

admission quickly if the porter were simply required to touch a button.

The electric lock shown in the cut is extremely simple. When a current is sent through the coils of the electro magnet *E* the armature *A* is attracted and causes the lever *D* to release the eccentrically mounted cylinder *G*, which is then free, to be turned by a spring against the bolt *P*. The door may then be opened. When the current ceases and the door is shut, the latter is again held firmly in position.

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307-308 Temple Court, Chicago, Ill.

NATIONAL ELECTRIC LIGHT CONVENTION.

IN this issue, and in the next four numbers of ELECTRICITY considerable space will be devoted to matters of special interest to those who will attend the semi-annual convention of the National Electric Light Association at Montreal, September 8th, 9th and 10th. In this number is presented a portrait of A. J. Corriveau, through whose efforts the association was induced to meet in Canada. The programme of the meeting is also published elsewhere in this issue. It will be noticed that the literary features of the convention are of a high order, and that elaborate preparations have been made for the entertainment of the delegates. No such social programme, we believe, was ever before arranged for a meeting of the association. According to every report the convention will be successful in all particulars.

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A DEVICE that will commend itself to superintendents and foremen of construction rooms is illustrated on another page. A contact device that can be used to open or close a circuit by simply removing it from its supporting hook can in many places be advantageously applied. A convenient use might be found in an erecting room where the device could be connected in circuit with an incandescent lamp, used on an extension cord, to illuminate darkened parts of machinery. It would also be found a very handy arrangement in a testing room where a constant resistance contact is so desirable.

* * *

ONE of the handsomest and best equipped electric lighting stations in Europe, that in Hanover, Germany, is illustrated and described in this issue. The plant is constructed on different principles from those which have prevailed on this side of the Atlantic. The triple expansion engines are coupled directly to the dynamos. This practice is beginning to commend itself to builders of electrical machinery in the United States, and recently a number of large dynamos designed for direct connection have been built. In this station accumulators are used on a large scale. Different from central station managers in the United States, the owners of large plants in Europe, and especially in Germany, have an abiding faith in accumulators for carrying the loads during the hours of small demand.

* * *

WE print elsewhere a communication from J. Stanford Brown in regard to the necessity of proper precautions against fire in electrical generating stations. He takes as his text the recent fire at the St. George, Staten Island, electric light station. He instances a case where in all probability a disastrous conflagration might have been averted had the very simplest precautions been observed. It seems strange that where so much is at stake, not only the expensive machinery and buildings, but the convenience of those dependent upon them, which cannot be measured in dollars and cents, the most ordinary precautions are so frequently omitted.

The fire mentioned by Mr. Brown, and that which occurred so recently at St. George, Staten Island, are but examples of what may occur at any time in many other places. It is to be hoped that they may not be in vain, and that the lessons thus taught, though costly, may in the end prove profitable. We are pleased to note at this point that strenuous efforts are being made to restart the currents at St. George's, and that it is expected in a few days to have the lights on again from a temporary plant now erecting.

* * *

FIRST we had the copper trust, and now it seems we are to have a rubber trust, or something, which if reports be true, will have the same effect on prices. For some time past the price of india rubber has been on the advance, and this was attributed to the rapid depletion of the sources of supply which, if true, meant a permanent reduction in the supply. It now appears that it is not so bad as all this, although bad enough. A report reaches us that Baron De Gomderiz, backed with $25,000,000, has cornered the entire visible supply. This same gentleman is credited with having accomplished the same thing once before -in 1883- and is reported to be in a stronger position now than then. The world's consumption of Para rubber is about 1,500 tons per month, more than half of which is used in the United States. The visible supply of Para rubber in the world August 1st, was estimated at less than 4,000 tons. It is supposed that the syndicate owns 3,200 tons of this, and is buying more. It is also claimed that it has capital enough to buy up the next season's crop, which will be ready in October. If all this be true, and it comes from apparently authortative sources—it means hard times for those interests in which india rubber is an important item.

* * *

ELSEWHERE we print a timely and most interesting letter from our special correspondent, on the subject of the International Electrical Exposition at Frankfort-on-the-Main. Mr. Sonn tells us that while there are points of merit in the display, beer halls, side shows and "fakes" of all kinds predominate to such an extent as to give to the whole the character of a catch-penny show. This is certainly to be regretted. The good advice and brief guide to visitors contained in his letter will, we think, be fully appreciated. Taken in connection with the birdseye view of the grounds and buildings, which appeared in ELECTRICITY of August 5, his letter will be a valuable aid to American visitors who do not speak the German language, since, as our correspondent says, the only official guide is published in that vernacular. The coupling of dynamos directly to the engine shaft, which he mentions as obtaining to a considerable extent, is in direct line with the more advanced American ideas, and the multipolar dynamo so driven has already secured a foothold in practice here and is generally believed to be the coming type and arrangement for large central stations. Exciting fields by accumulators is something new to us on this side of the Atlantic; in fact, we have much to learn of our friends across the sea in the use of the storage battery. With rope belting, the use of which he makes mention, we have long been familiar. Perhaps the most astonishing feature of the Exposition, as described by Mr. Sonn, is the absence from among the list of electrical celebrities of Faraday's name. The propriety of canonizing contemporaries is a question about which there is a difference of opinion. For this reason the omission of Edison's name excites less remark. But, if not Faraday who?

* * *

IF THE world were not full of gulls, baits would no longer be thrown out. We are constantly hearing of new motive powers, and the lay press announce the same old thing, over and over again, with a gusto born of the enthusiasm of a new discovery. The carbon bisulphide or other vapor motor springs up perennially, sometimes in new dress, but more frequently in the same old garments, and heated air is nearly as old as steam. The latter has been a favorite theme with such men as Ericsson, Wilcox, Roper and Shaw of this country and Lauberau and Belau of France, and it is probable that they have gotten out about all there is in it. The attractive feature of hot air engines lies in the fact that the cumbersome and expensive boiler may be dispensed with, but the theoretical efficiency of an engine of either kind is measured by the difference between the initial and final temperatures of the vapor or gas employed. Air of all the gases least readily lends itself to rapid and large changes of temterature and therefore can not, on theoretical grounds, give the same efficiency as steam. Thus, if air be employed at an initial temperature of 580° F. and be exhausted at the average temperature of the atmosphere- say 62.5° F.—the former being as high as it is practicable to use air, and the latter as low as it is feasible to reduce it there will be a theoretical efficiency of but 50 per cent. a figure much below that obtained in ordinary practice with steam. Just now there is an article going the rounds of the papers entitled, "A New Power. Steam and Heated Air Out work Steam. Possibly a Revolution." Then follows a sensational account of what is claimed for this mongrel power. We trust that no readers of ELECTRICITY will be led by these accounts to believe that by diluting a good thing with an inferior article a larger quantity of superior quality will result. This wonderful "new power" should, and will, be relegated to the same category to which naptha, carbon bisulphide and other inefficiences belong.

NEW CENTRAL STATION, HANOVER, GERMANY.

BY GUSTAVE MONRATH.

The accompanying cuts illustrate one of the largest and best equipped plants for city lighting in Europe, the new central station of the city of Hanover, Germany. In November, 1889, the city council made an appropriation for an extensive plant for incandescent lighting. After a sharp competition between four of the largest electric companies in Germany, which almost provoked a feud, the contract was awarded to the firm of Schuckert & Co., of Nuremberg. Work was commenced in May, 1890, and in March, this year, the first section of the light district was illuminated. The capacity of the plant is about 30,000 sixteen candle power lights. The magnificent station, of which the frontispiece gives an interior view, has a frontage of 105 feet and a depth of sixty-nine feet. A smoke stack extends from the center of the building 150 feet in the air.

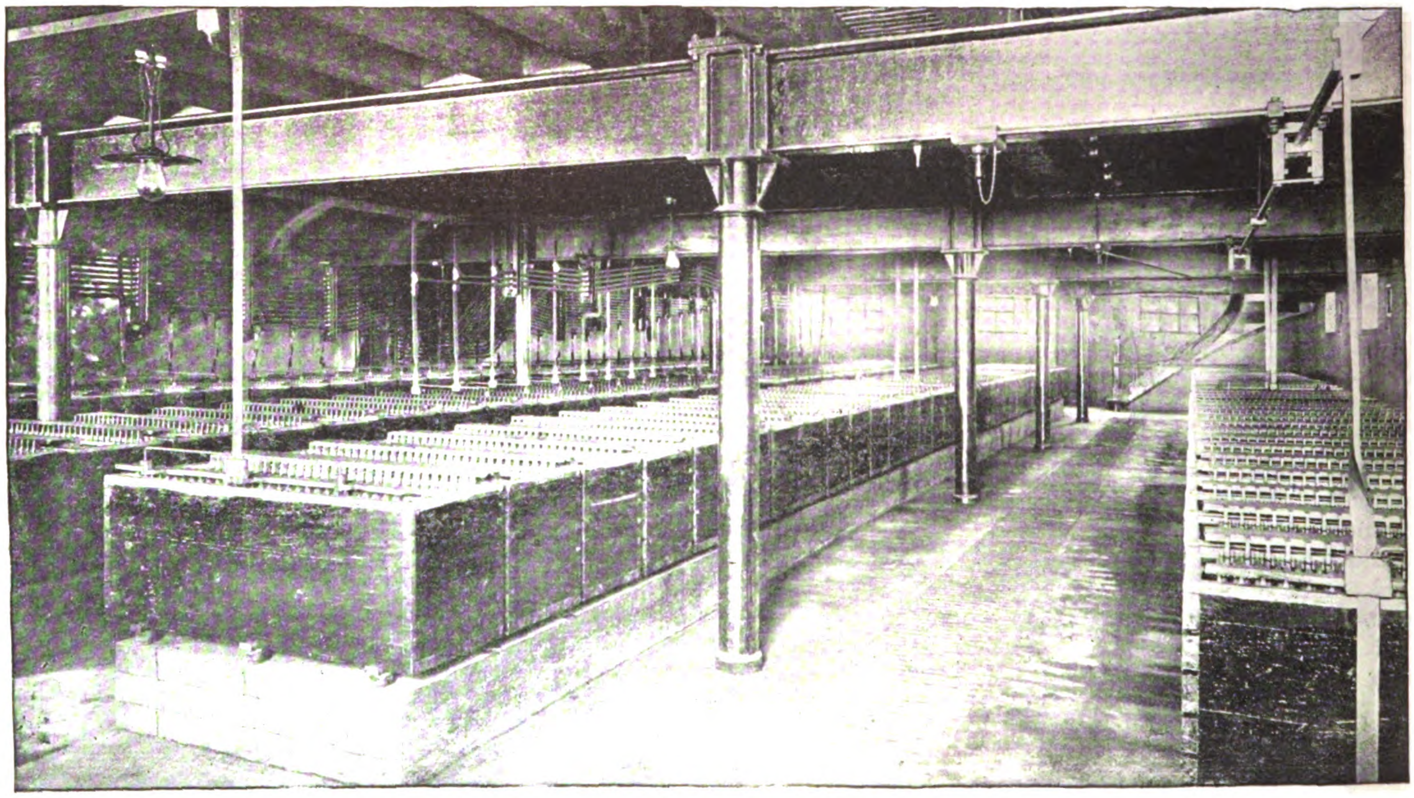
The building is divided into three departments; boiler room, engine and dynamo room, and accumulator rooms. The boiler room contains three Steinmueller high pressure boilers, each having a steam generating surface of 1630 square feet, and developing per each square foot from two and one-half to four pounds of steam at a pressure of twelve atmospheres. The boiler room is large enough to receive two additional boilers of the same type, but of larger capacity. Anthracite coal is used exclusively.

In the machine hall are two vertical triple expansion engines with injecting condensers, built by Schickau & Co., of Elbing. The engines have a normal capacity of 300 horse power,(maximum 400 horse power) at 115 revolutions per minute, and 150 pounds steam. The efficiency is claimed to be eighty-five per cent, with eleven and one-half pounds of steam per horse power hour.

Each engine is coupled directly to a Schuckert flat ring dynamo of a capacity of 275,000 watts. The pressure obtainable is 320 volts and the maximum output 1100 amperes for each dynamo. The dynamos have sixteen poles and eight brushes sliding on a commutator six feet in diameter. The armature is nine feet in diameter and the efficiency of the machine is claimed to be ninety per cent. The switchboard, which is tasteful but simple in construction, contains, besides the regular meters, switches and regulating devices, a set of automatic switches controlling the charging and discharging of the accumulator. The machine hall has room to accommodate two additional dynamos to meet future demands for light.

The accumulator department is divided into four stories, each of which has room for 136 storage batteries of the Tudor pattern. At present only the two lower floors are occupied. The batteries are constructed for a charging current of 330 amperes and are capable of a discharge of 396 amperes, with a total capacity of 1320 ampere-hours per battery. At each end of the accumulator room are located twenty-six cells which are used as a switch battery. The flooring between the several stories is partly made of perforated iron plates so as to permit good ventilation through the building.

The distribution is effected on the three-wire underground system, and is divided into five main sections. As main feeders single lead-incased cables are used which are placed in U-shaped iron troughs. The same kind of iron protection is used for all crossings and taps. The service wires leading into buildings are lead-encased cables, but are protected by a sheet iron armoring, and are placed free in the ground.



Municipal Electric Light Station at Hanover—Accumulator Room.

The distance from the central station to the most remote subscriber is 2,500 feet in a direct line. The subscribers number 330 and the number of lights in service aggregate 8,000, which are distributed on 270 sets of branch wires leading into buildings.

The consumption of current is controlled by watt-hour meters and the price charged to subscribers is 2.4 cents per 100 watt-hours, with a discount of from 5 per cent. to 25 per cent. in proportion to the amount of current consumed. For summer gardens and pleasure grounds using light only from March 15 to October 15, the price is only 1¼ cents per watt-hour. Current furnished for motor service costs 5½ cents per horse power hour with a discount of from 15 per cent. to 40 per cent. for consumption of from 1500 to 3500 working hours yearly.

The station is successful both as an electrical plant and a business enterprise, and no complaints are heard from neighbors of the station on account of smoke or noise. The photographs from which the cuts were made were sent to Electricity by Schuckert & Co., of Nuremberg.

ELECTRICAL CURRENT TOPICS.

Who would ever expect to meet with as frivolous a sentence as this in a review article on electric lighting by Lord Rayleigh? "Those who indulge in the luxury of reading in bed have a grand time before them."

* * *

"I am not given to borrowing trouble," remarked a Chicago man the other day, "but there is one matter that is worrying me a little. My temporary residence this summer is in a flat that is lighted by electricity and it is unfitting me for my own home where I'll have to put up with gas again. One can hardly realize the comfort there is in living in electrically lighted apartments in the warm summer months until he has enjoyed the privilege and noted the contrast between such quarters and rooms where the air becomes overheated from burning gas."

* * *

The organization of a company formed to build an underground road in Chicago was noted in the last issue of Electricity. While it was thought that the construction of such a road was rather improbable, the consideration of the project shows that there is still room for additional transit facilities on the South Side. On July 4th there were 125 trains of three cars each on the Cottage Grove cable system, and yet people were waiting along the line anxious to obtain even standing room. The suburban trains of the Illinois Central were fairly packed. The cable trains on State street were crowded throughout the day. If such is the state of things now what will be the demand in 1893? Surely there is traffic enough to make other roads pay even in addition to the Alley L. Most of us would like to traverse south by an electric railway.

* * *

W. S. Andrews of New York, reached Chicago last week after a tour in which he visited a considerable number of Edison stations. The plants which he inspected were, he said, in a prosperous condition, and the prospect was promising. They were, he said, continually increasing the load on their power circuits, as the advantages attending the use of electric motors were appreciated. Changing the subject Mr. Andrews said: "The Minneapolis-St. Paul Electric Railway is working splendidly. Think of going from one city to an-

other in forty minutes, and for ten cents. I rode on the line considerably, and I never saw an accident of any kind.

"By the way, I met on my trip a man who was present at the execution of the murderers, by electricity a few weeks ago. He is a man whose word can be depended upon, for I have known him for a long time. He told me the whole story, and stated it as his opinion that death in every case was instantaneous. His conclusion was that this method of putting criminals to death, was entirely humane. Never mind about the gentleman's name. You are safe, I presume, in publishing this statement, inasmuch as you don't issue your paper in New York."

* * *

It has been suggested that signs illuminated by electric lights be placed on the street cars in Rochester, N. Y. This is an illustration of the fact that one improvement creates a demand for others. About a year ago Rochester street cars traveled so slowly that one could walk along by the driver's box and learn from him all about the route. Now with rapid transit it is necessary that this information shall be more readily obtained.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The outlook for the convention of the National Electric Light Association, at Montreal, September 8, 9 and 10, is in every way promising. Arrangements are progressing satisfactorily, and those who attend will have a thoroughly enjoyable visit. The sessions of the convention will begin at 10 A.M. and continue until 2 P.M., when an adjournment for the day will take place. The programme is as follows:

SEPTEMBER 8, 1891.

The reports of the following committees will be discussed:

Committee on relations of manufacturing and central station companies; committee on data; committee on World's Columian Fair; committee on legislation; committee on underground conduits and conductors; committee on safe wiring.

SEPTEMBER 9.

Papers will be read and discussed as follows:

Discussion of T. Carpenter Smith's paper, read at Providence, on the "Distribution and Care of Alternating Currents."

W. C. Warner.—"Various Forms of Carbons for use in Arc Lamps."

Capt. Eugene Griffin.—"Three Years' Developments of Electric Railways."

H. Ward Leonard.—"A Central Station Combining the Advantages of Both Continuous and Alternating Current Systems."

SEPTEMBER 10.

J. I. Ayer.—"Some Details of the Care and Management of an Arc Lighting System, as practiced in the Municipal Station of St. Louis.

C. J. Field.—Subject to be announced.

Geo. A. Redman.—"Central Station Lighting by Water Power."

J. J. Burleigh.—"Uniformity of Method in Keeping Central Station Accounts."

An executive session will be held to elect three new members of the executive committee and to name the place of the next meeting.

ENTERTAINMENT PROGRAMME.

The following is the programme arranged for the entertainment of the National Electric Light Association by the Citizens' Executive Committee, Montreal.

Monday, Sept. 7th, 3 P. M.—Opening proceedings of the convention in the Windsor Hotel, address of welcome by the mayor and other distinguished members of the reception committee.

8 P. M.—Formal opening of the Exhibition by the Governor General.

Tuesday, Sept. 8th, 3:30 P. M.—Drive through the city and around the Mountain.

8 to 11:30 P. M.—Conversazione at Redpath Museum, Molson Hall, McGill College.

Wednesday, Sept. 9th, 2:30 P. M.—Fire Department Display on Champs de Mars.

5 to 7 P. M.—Garden Parties.

8 P. M.—Banquet at the Windsor Hotel.

Thursday, Sept. 10th, 2:30 P. M.—Through the kindness of the Harbor Commissioners, trip by boat down the St. Lawrence and the Lachine Rapids, stopping on the way at Caughnawaga.

5 to 7 P. M. Garden Parties.

Friday, Sept. 11th, 3 P. M.—Lacrosse Match. In the evening, Promenade Concert at Sohmer Park, through the courtesy of Messrs. Lavigne and Lajoie.

Saturday, Sept. 12th, 7 P. M.—Excursion to Quebec at reduced rates.

In addition, yachting parties are being arranged for the entertainment of the ladies.

A. J. CORRIVEAU AND THE MONTREAL CONVENTION

It was almost entirely through the efforts of A. J. Corriveau that the National Electric Light Association was induced to hold its semi-annual convention in Montreal. More than one obstacle was in the way. A sentiment against summer meetings was shared by many members, and not a few considered it a singular proceeding for an organization which styled itself national, to meet in Canada. These objections and a host of others, Mr. Corriveau successfully combated, and he had the satisfaction of securing a favorable vote. Since that time he has worked early and late to make the meeting successful, and to realize all the predictions which he made of a Montreal convention. The incident illustrates a characteristic of Mr. Corriveau. He is energetic, tireless, enthusiastic, and largely to his efforts will be due the success of the Montreal gathering.

Mr. Corriveau was born at St. Thomas de Montmagny, March 29, 1851. The last ten years he has passed in Montreal. When a young man Mr. Corriveau spent several years in the United States, studying the manufacture of silk, and in 1881 he started a silk factory in Montreal; the first, it is

A. J. CORRIVEAU.

believed, in the Dominion. He became interested in electric lighting a number of years ago, when staying at St. Hyacinthe, a summer resort thirty miles from Montreal. He was successful in locating a plant at that place, and soon after became the general agent of the Royal Electric Company of Montreal. He was extremely successful in introducing electric appliances, although at that time the Canadians were inclined to be skeptical of the new means of illumination. Canada has magnificent water power, and realizing the advantages attending the electrical transmission of power, Mr. Corriveau was successful in interesting a large number of companies in projects for the utilization of water falls. The plants which he was instrumental in installing include many of the largest in Canada. After leaving the Royal Electric Company he formed the Electrical Construction, Supply & Manufacturing Company, of which he is president and general manager.

Personally Mr. Corriveau is extremely affable. He is a popular man in Montreal and has always taken a prominent part in the fetes and carnivals for which Montreal is famous. In most of the pictures of Montreal fetes, which are exhibited so freely in the windows of the city, Mr. Corriveau's portrait can be distinguished. In 1876 he married Mlle. Lebriceide Kerouack.

INTERNATIONAL ELECTRICAL EXHIBITION AT FRANKFORT.

(Special Correspondence.)

FRANKFORT, August 1, 1891.—The foreigner should approach the city by night, and thus secure from a distance a view of the illuminated dome of the main building of the exhibition. The beauty is marred in a nearer view by the dense vapors of countless jets of escaping steam. The illuminated elevator, and the search lights of this elevator and of the tower by the riverside will also appear to better advantage. The visitor will act wisely too in making a careful study of a map of the exhibition grounds. He will do well to eliminate, with a heavy pencil, all beer halls and side shows from the diagram. As there is no catalogue or guide published in any language save German this is quite necessary. He will then find himself limited in his perambulation to a central structure termed Grosser Maschinenhalle, and small side buildings labeled as follows: Eisenbahn, Telegraphie und Telephonie, Electro-Chemie, Wissenschaft und Medicin. Several enterprising firms have small structures of their own; otherwise the thirty and more edifices are given up to beer and wine and "fakes."

The exhibition cannot properly be termed international. Two or three American concerns are represented through their foreign agencies. French genius and ingenuity is noticeably absent. A careful scrutiny of the catalogue will reveal several well-known names of English electrical houses.

In the main building the most prominent position is assigned to the big multipolar dynamos, Helios, manufactured by the Koeln-Ehrenfeld Company. The largest is run by an engine with a maximum capacity of 600 H.P., and is advertised to run 6,000 glow lamps. The dynamo is coupled directly to the engine and the field magnets are excited by means of accumulators. It supplies the current for certain arc lights and glow lamps at the exhibition and for a circuit that extends to the Palm Garten in the suburbs. This dynamo supplying a 2,000 volt current of 400,000 watts is to a visitor who has seen other celebrated electric exhibitions the only remarkable feature at Frankfort.

It marks the progress made in electricity since the Paris exposition of two years ago. And there is little else in Frankfort that shows the same thing. In beauty of design and variety of arrangement the display of chandelier work is inferior. One point more in this apartment is noteworthy and that is the number of dynamos coupled directly with engines without intervention of belting. The bug-bear of electricians of former years, the slipping of the belt, is avoided. In several cases rope "belting" is used, five endless cotton ropes playing in grooves replacing the leathern belt.

In the Telephone and Telegraph exhibit we should certainly find many things novel. The Germans have had unlimited opportunity to develop the telephone unrestricted as they have been by any monopoly restrictions. But they give us little that is new. The central station switchboards in two exhibits are very compact. The exhibit of transmitters and receivers shows several forms of combined receiver and transmitter, so constructed that the mouth of the user is at just the proper distance from the transmitting diaphragm when he holds the receiver to his ear. This device should be universally adopted.

In this hall, which is, we might add, rather diminutive, the English Phonograph Company is making a mint of money with its instruments. It is the only place in the show where Edison's name appears. In the ballet show at the theatre in the grounds there are beautiful displays of light effects in several of which appear the names of great electricians. The names of Edison and Faraday are not presented. Their claims to a

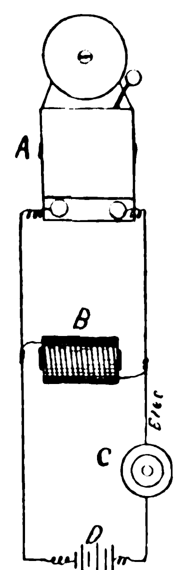
high niche in the temple of fame are evidently ignored. That reminds me that one day last week in a German city, I found myself facing a monument to the inventor of the telegraph. He was a German, of course!

The phonograph is not so well known to the Germans as it is to us. You will find slot machines everywhere but I have yet to find a phonograph publicly exhibited outside of this place. The display of telegraph instruments is very limited, that of clocks, electric and otherwise, taking up as much as a half of the building. There is a neat exhibit of telegraph wire insulators. One device for bringing in wires to a head office is that of a dome with lattice work, the insulators being arranged on the lattice work, making a pretty piece of work and showing a praiseworthy economy of space. In telegraph poles the exhibit is meager. An hour in Amsterdam would show better what can be done in making wiring look attractive in cities. This is partly due to the fact that in most of the German cities all wiring must be underground or on house tops. There is certainly fine work done in this connection. The spans sometimes covered are surprisingly great, and you fail to discover any sagging. Across the Main, wires are not allowed on the bridges, although the bridges are large and numerous. The wires run from house tops on one side of the stream to house tops on the other side! The river is as wide as the Passaic at Newark, and wider than the Harlem; and the sagging is very slight. This length of span is not at all unusual. There are devices employed with which a workman by a twist of his hand can make taut the wires on the house tops. The authorities are very exacting in this matter. The railroad department, beside conventional signaling and switching apparatus, shows a car equipped with boiler, engine and dynamo, in fact a light station. In front are two search lights that can be turned anywhere. The car is evidently meant to be put in front of the locomotive. Wires are coiled on the underside on spindles so that they can be run off to connect with the other cars of the train. The whole is a very useful device for the German Army. An electric light circuit construction wagon is also an interesting specimen of what ingenuity can do when urged on by necessity. The vehicle is equipped with every thing needed for laying cable and making tests of circuits. A portable fire engine worked by electric motor is a novelty. The test made during my stay was not very successful. The cart was run by German firemen to the lake with its illuminated waterfall. Wires were run out from the motor to connecting posts in a box at the lake and the current of 110 volts was sent from the station twenty yards away. The pump worked spasmodically, the random never exceeding fifty feet. The test was abandoned for the day. There is no reason why the device should not prove effectual if properly constructed. If introduced into our large cities, firemen would be relieved from at least one source of smoke that hinders their work.

The adjacent building is devoted to electrometallurgy. It contains an assortment of plated ware, plating baths, ores, and several plating dynamos. Among the last named is one with an advertised capacity of 450 amperes at 2 volts with 700 revolutions; another 400 amperes at 15 volts with 850 revolutions; and still another of 180 amperes and 4 volts with 1100 revolutions. There is what purports to be an electric ore-separator in this building. Samples of raw ores, and of extracted metals, gold, silver, copper and iron are shown, and a large box surmounted with a hopper. Siemens & Halske occupy the rear end of this building. They occupy large space in every building and have several small structures of their own besides. In addition they are running a specimen electric street car in the city, a mining car equipment, a model theatre, toy size, with interesting effects in illumination, and a slot machine, all for pay. The company has a very large exhibit; in fact the exhibition would be seriously crippled without it. Still there is something uncongenial to American ideas in this combination of thrift and ingenuity that seeks in every way to make money out of an industrial exhibition in addition to a large entrance fee. G. C. Sonn.

HINT FOR BELL HANGERS

To the Editor of Electricity.—I send you a sketch that I think will be interesting to bell hangers. I have had occasion to apply the idea on several occasions and have found it a very handy arrangement. The diagram shows an ordinary bell circuit in which *A* is the bell and *D* is the battery. *C* is a common push button for closing the circuit. With this arrangement it sometimes happens that the bell will not ring on account of the high resistance of the magnet coils or because the circuit is too long or possibly because the battery is not strong enough. The remedy that would naturally suggest itself would be to increase the batteries. It often happens, however, that it is impossible to readily obtain another battery, so I devised the scheme of placing a coil of wire, of a little less resistance than that of the bell, across the circuit as shown at *B*, and thus causing the bell to ring. My explanation of the action is that when the circuit is closed and the current allowed to flow, part of it passes through the coil *B* and part through the bell; as soon as



Hint for Bell Hangers.

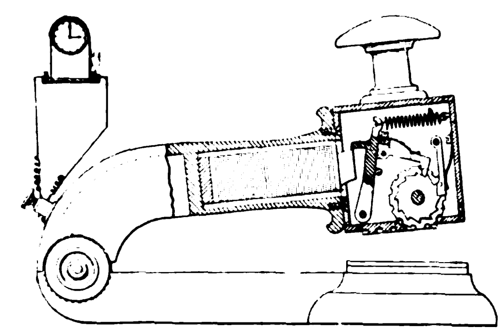
the current is interrupted in the bell the whole of it passes through the coil *B*. When the circuit is again completed by the armature of the bell falling back into its original position, a secondary current is sent through the magnetic coils of the bell.

I am not certain that this explanation is correct or that this idea has not been published before, but I think that it will help a number of bell hangers out of a difficulty that it has helped me out of. W. B.

ELECTRIC TIME STAMP.

At the present day of complex business transactions, it is frequently desirable that papers should be dated not merely with the year and day, but with the exact minute. Numerous efforts have been made to construct a time stamp, which would meet the requirements by providing a simple and accurate means of denoting the time to the minute. These efforts have been chiefly confined to mechanical constructions, in which a clock movement is so embodied in the stamping apparatus as to change the latter automatically to correspond with the correct time. The difficulties, however, in the way of constructing an accurate and durable instrument of this kind, have been found almost insurmountable, on account of the irregular and excessive strain placed upon the time train, and because the blow, incident to making an impression, demoralized the time piece.

An effective means of solving the problem is found in the application of electricity for changing the stamp automatically in synchronism with a clock, by means of a circuit closer placed in the time piece and connected with the stamp in circuit with an electric battery. The circuit is closed once a minute by the clock, which causes an electro-magnet in the stamp to attract its armature and thus change the minute wheel one step. At the sixtieth minute the hour wheel is moved, and so on to the day of the month. The clock may be removed to any distance from the stamp and is not affected by the jarring. Any number of stamps may be operated in the same circuit and may be regulated by one clock.



Electric Time Stamp.

The accompanying cut shows one of these instruments designed for ordinary office use; other forms are constructed and for special uses, such as for post offices for recording the time on a continuous tape. The inventor is J. B. Martindale of Chicago.

STATEN ISLAND FIRE.

To the Editor of Electricity: The plea for "compartment isolation" in central station construction, brought forward by M. C. Sullivan in his excellent article on p. 42 of your issue of August 12 '91, (Vol. I, No. 4), and endorsed in your leader of that date, must appeal to all engineers as a most important point.

In regard to the Staten Island fire, it should be remembered that there was trouble with the water supply so that the flames gained headway impossible later to subdue. Whether proper watchmen were around or not at the St. George plant, is unknown to the writer, but the carelessness exhibited in many parts of the country in leaving central stations filled with costly machinery and where its destruction would cause so widespread inconvenience, is to be greatly wondered at. For instance, take the burning-out at Narragansett Pier, Sunday, July 5, '91. The fire started about noon in a lot of rubbish, straw packing, etc., old oil barrels and arc globe casks, all heaped in a pile just outside the building and not fifteen feet from it. The writer passed them the day before and commented to a friend on the chance for a fire.

No watchman was employed. The man who first saw the flames from his house, a block distant across the fields, ran over and said afterward that had he had a rake he might have hauled the burning mass away and saved the building. The railroad station a step beyond was locked and no watchman was there, so that neither telephone nor telegraph message could have been sent even if the apparatus were "getat-able," for the operators were "off" for dinner. The delay thus incurred in getting the alarm to the fire department down town, resulted in the gutting of the building, although by valiant effort the apparatus was saved so that part of the circuits were running the next night. The boilers working uncovered presented a curious sight as well as the dynamos seen through the still dripping ruins. It was the fire wall that saved the

engines and dynamos down stairs, though the flames crept up and destroyed all the upper part of the building.

It would seem an insane policy to save (?) the expense of a watchman at the risk of total loss of plant.

New York, Aug. 15, 1891. J. Stanford Brown.

ELECTRIC RAILWAY AT LINCOLN, NEB.

Those who have not watched the growth of Lincoln, Neb., are naturally astounded to learn that this western city has forty miles of electric railway lines. These roads are now under the control of a single corporation recently formed, and known as the Lincoln Street Railway Company. The city has a population of 60,000, and the company finds itself in a prosperous condition. The lines are well patronized and since the electric equipment has been completed several of the lines have almost doubled their earnings. The motor lines were operated for the first time on June 16th.

The single trolley system is employed throughout. Three of the roads are about four miles in length. Several makes of apparatus are used on on the lines. Thomson-Houston, Short and Westinghouse motors are operated on the cars, and Thomson-Houston generators furnish current. The generators are four in number, each multipolar of 100 horse power. They are driven by four Dick & Church tandem compound engines. Steam is generated in three Phœnix boilers.

The station shown in Fig. 1 has twenty-six independent tracks entering the building, so that both traverse table and turn table are unnecessary. The generating station is located in the center of the building and is ventilated by an exhaust fan operated by a Detroit motor. The smoke stack is 120 feet in height. For 50 feet it is constructed of brick, and the remainder is steel. The stack is anchored by eight three-quarter inch iron rods. The top of the brick work is furnished with a flange of cast iron, weighing three thousand pounds, which acts as a cap for the brick work, and a base for the steel, forming practically a joint at that point. High winds prevail in Lincoln, but the stack has always remained steady.

The feeder and trolley wires were run separately. A tower wagon shown in Fig. 2 was especially constructed for running the feeders. As the wagon proceeded the feeder wire was lifted into place as each cross arm was reached. Three, and often four miles of feeder wire were put into position daily by a gang of eight men. The tower wagon was preceded by a wagon carrying two tons of 000 wire. The trolley wires are not soldered, but are held in position by means of a phosphor bronze sleeve that passes completely around the trolley wire and is attached to a clamp screwed into the span-wire insulator. The line material was furnished by the Electrical Supply Company of Chicago. All the line construction was done under the supervision of S. W. Childs.

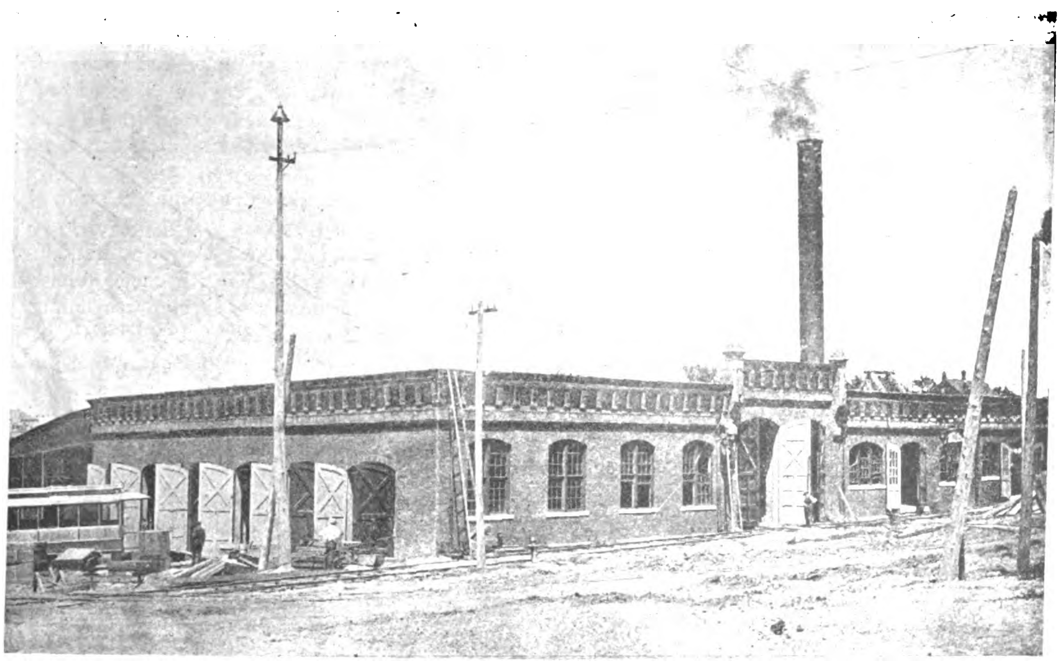


Fig. 1—Electric Railway at Lincoln, Neb. Station.

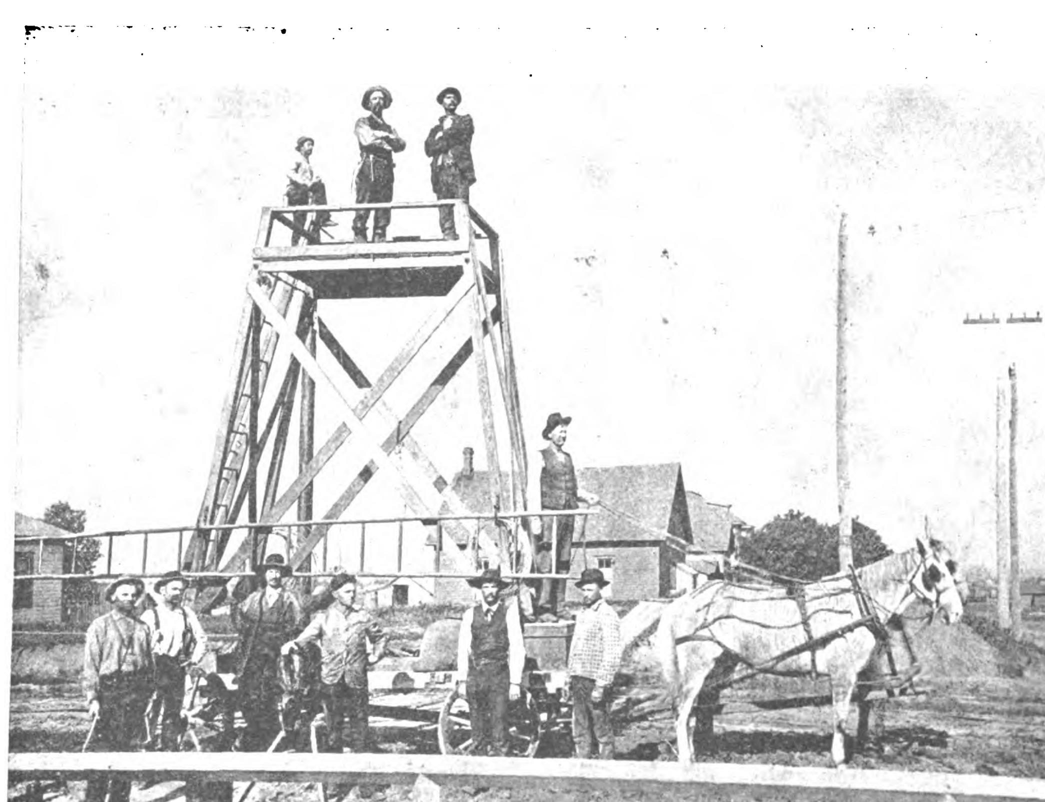


Fig. 2—Electric Railway at Lincoln, Neb.—Running the Feeder Wire.

ELECTRIC LIGHT PLANT ON THE STEAMSHIP "VIRGINIA."

The new twin screw steamship "Virginia" recently added to the fleet of the Goodrich Company, Chicago, is said to be the handsomest and most elegantly appointed passenger steamship sailing on fresh water. One of the many features that combine to make this vessel attractive is its electric light plant. The plant is composed of two Beck automatic engines of fifty horse power each, and two Mather dynamos having a capacity of 800 lights. Each engine is belted to a dynamo with Underwood's V-belts, which are specially adapted to working on close centers. The space occupied by each engine and dynamo is only ten by twelve feet. At present 700 lights are used to illuminate the boat. These are arranged around the deck and cabins in such a manner as to produce a brilliant effect. The dining saloon has over 150 lights arranged around the sides and on the chandeliers. Besides furnishing current for the incandescent lamps the dynamos and circuits are so arranged that they will supply current for a 35,000 c.p. search light which is to be placed on board the boat at the opening of next season. The switches, electrical fixtures and chandeliers were manufactured from designs by the Mather Company especially for the boat. The entire electric light plant was furnished and installed through the western office of the Mather Electric Company.

THE MUDDLE AT NEWPORT, KY.

The Mayor and the City Council of the city of Newport, Ky., recently found themselves in a peculiar predicament, out of which they do not yet see their way. Some time ago the city government entered into a lighting contract with the gas company extending over some years. The contract has still a considerable time to run. Nevertheless the authorities assumed, for some reason, that they had a right to rescind the old and make a new contract with the local electric light company, which they proposed to do. The gas company obtained an injunction against the city authorities, but the latter nevertheless closed the contract with the electric light company. The mayor and city council were thereupon summoned before the court at Louisville, and though defended by Senator Carlisle and other eminent counsel were adjudged in contempt, but given ten days in which to purge themselves.

Now the electric light company comes into court and obtains a decree compelling the mayor and council to fulfill their contract with it. It remains to be seen what the upshot will be. Whichever course the authorities pursue they will be in contempt of court. It looks as though the City of Newport would be well lighted, as the only apparent way out of the dilemma is to fulfill both contracts. This will not satisfy the letter of the law because the city has been enjoined from making a contract with the electric light company, but it is probable that the gas company will be satisfied if only it is allowed to fulfill its contract.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

The Association of Edison Illuminating Companies held the first session of the annual convention at the Murray Hill Hotel, New York, August 11. The attendance was large; the list of members appended shows the presence of representatives from a large number of Edison Illuminating Companies from all over the country, in addition to the representatives sent by the Edison General Electric Company, and Mr. Edison.

The morning session was taken up with the reception of credentials of delegates, an address by the president of the association and the reading by A. E. Kennelly, of Mr. Edison's Laboratory, of reports of committees on "Grounding Neutral Wire on Three-Wire System,"and"Lightning Protection." A report by G. P. Gilbert, of Detroit, Mich., Chairman, on "Dangers to Edison Circuits from Crosses with High Potential Conductors" was read by H. Ward Leonard, manager of the Light and Power Department of the Edison General Electric Company. The reports were followed by a free discussion of the topics.

The convention extended the privileges of a portion of the session to A. S. Hibbard, general superintendent of the American Telephone & Telegraph Company, and John J. Carty, electrician of the Metropolitan Telephone & Telegraph Company, during the discussion of the reports on protection from lightning and high potential circuits.

On reconvening at 2:30 p.m., the delegates were invited by the officials of the Edison Illuminating Company of New York, to visit in carriages their various operating stations and the new Elm street station now in process of construction; also to accept the further hospitality of this Company in a dinner at the Brighton Beach Hotel, returning in the evening.

The second day's meeting was called to order promptly at 10 a. m. by the president, John I. Beggs. The morning was taken up by the discussion of Prof. A. E. Kennelly's report on the "Grounding of the Neutral Wire in Three-Wire Systems;" read the day before; the reading of a paper by Prof. Wm. D. Marks, supervising engineer and general manager of the Edison Electric Light Company, of Philadelphia, on "How to get Paying Loads for Stations," the reading of a paper by R. S. White on "The Edison Meter in the Brooklyn station;" an address by Sam'l Insull, second vice president of the Edison General Electric Company, on the present business policy of the parent company, the outlook in the patent suits, the condition of the business, etc. At the close of the session, the preliminaries of Mr. Insull's "jolly good time" on the following day at Schenectady, were gone through with by distributing the invitations for the excursion to the members.

On the 13th the train started at 9 a. m. from Grand Central Station, and the greater part of the day was spent in an inspection of the Schenectady Works of the company. In the evening the delegates were invited by the New York Illuminating Company to attend the Gilmore Concert at the Madison Square Garden, to inspect the immense isolated plant in the building, and also the stage electrical arrangements in the German Theatre.

The list of those present follows:

MEMBERS PRESENT.

Edison General Electric Company, J. Hobart Herrick, vice-president; E. H. Johnson, director; Sam'l Insull, 2nd vice-president, J. P. Ord, comptroller; S. Dana Green, assistant to 2nd vice-president; Morris Slatterly, agent Southern district; F. R. Upton, general manager lamp manufacturing department; Sidney B. Paine, district manager New England district; W. S. Kelley, engineering department; L. Stieringer, engineering department; H. T. Edgar, engineering department; W. T. M. Mottram, assistant to district manager Southern district; S. A. Douglas, north eastern district. Lamp manufacturing department, Wilson S. Howell, inspector, and Francis E. Jackson, inspector; light, power and intelligence departments, H. Ward Leonard, general manager; legal department, W. J. Jenks, E. W. Hammer W. H. Lauman; eastern district, Chas. D. Shain, district manager; southern district, A. H. Reece, district manager; official stenographer, W. J. Sullivan; Edison laboratory, A. E. Kennelly.

Edison Electric Illuminating Company, of New York City, R. R. Bowker, 1st vice-president; J. B. Shehan, treasurer; H. J. Smith, general operating superintendent; J. Van Vleck, Arthur Williams; Henry Stephenson, superintendent of underground construction; F. M. Tottingham, superintendent second district; Frank H. Briggs, acting superintendent third district; W. I. Donshee, assistant electrician; J.E. Sayles, general agent; J. H. Tyler, superintendent meter department; H. A. Campbell, assistant superintendent.

Edison Electric Illuminating Company, of Brooklyn, N. Y., C. E. Chinnock, director; W. D. Barstow, general superintendent; R. Lindsay.

Edison Electric Illuminating Company, of Boston, Mass., Walter C. Baylies, vice-president; C. L. Edgar, general manager; W. A. Hill, cashier; Chas. E. Pattison.

Harrisburg Electric Light Company, Harrisburg, Pa., John I. Beggs, director; W. R. Fitzpatrick, superintendent and electrician.

Edison Electric Illuminating Company, of Detroit, Mich., C. P. Gilbert, secretary and manager; Hoyt Post, attorney; Barton L. Peck, motor inspector.

Edison Electric Illuminating Company, of Philadelphia, Pa., Wm. D. Marks, supervising engineer and general manager.

Edison Electric Illuminating Company, Patterson, N. J., Wm. M. Brock, manager and secretary.

Edison Electric Illuminating Company, Pottsville, Pa., Geo. H. Barker, manager.

Toronto Incandescent Electric Light Company, Toronto, Canada, J. K. Kerr, director and attorney.

Reading Electric Light & Power Company, Reading, Pa., T. P. Merritt; J. K. Righter, general manager.

Grand Rapids Edison Light & Fuel Gas Company, Grand Rapids, Mich., A. F. Walker, superintendent; T. C. Harnish, constructor.

Appleton Edison Light Company, Appleton, Wis., A. L. Smith, president.

Consolidated Electric Light Company, Birmingham, Ala., Leigh Carroll, secretary and general manager.

Des Moines Edison Light Company, Des Moines, Iowa, J. A. Colby, director, secretary and manager.

Columbus Edison Electric Light Company, Columbus, Ohio, A. W. Field, secretary and manager.

Edison Electric Light & Power Company, St. Paul, Minn., Geo. H. Finn, secretary and treasurer.

Edison Electric Illuminating Company, Lawrence, Mass., W. H. Wolverkamp, electrician.

Edison Electric Illuminating Company, Topeka, Kan., W. W. King, superintendent.

Edison Electric Illuminating Company, Westchester, Pa. Maurice Hoopes, superintendent.

Edison Electric Light & Power Company, Kansas City, Mo., W. Preston Hix, director.

Tiffin Edison Electric Illuminating Company, Tiffin, Ohio, A. Kaup, manager.

Edison Electric Light & Power Company, Little Rock, Ark., G. H. Van Etton, president.

Elgin City Railway Company, Elgin, Ill., Chr. Wustenfeld, manager.

Scranton Illuminating, Heat & Power Company, Scranton, Pa., J. E. Parrish, superintendent.

Wilmington City Electric Company, Wilmington, Del., C. Reginald Van Trump, general superintendent and manager.

Toronto Incandescent Electric Light Company, Toronto, Canada, Frederic Nicholls, manager and secretary.

Renovo Electric Light, Heat & Power Company, Renovo, Pa., J. H. Sheddy, general manager.

Forest City Electric Light & Power Company, Rockford, Ill., M. A. Beal, secretary and treasurer.

Mt. Holly Electric Light & Power Company, Mt. Holly, N. J., J. L. Jamison, superintendent and treasurer.

Edison Electric Illuminating Company, Rochester, N. Y., H. L. Brewster, secretary.

Edison Electric Illuminating Company, Amsterdam, N. Y., J. H. McClement, vice-president; H. K. McCoy, general manager; T. D. Mosscrop, secretary and treasurer.

Winston-Salem Railway & Electric Company, Salem, N. C., J. H. McClement, president; H. S. Cooper, general manager.

Edison Electric Illuminating Company, Hazleton, Pa., J. Edwin Giles, manager.

Edison Electric Illuminating Company, New Orleans, La., Wm. Oswald, director.

The Edison Illuminating companies somewhat relaxed the rigor which inevitably characterizes the proceedings at their annual convention, by taking on the 13th inst. a trip to Schenectady, in which pleasure and business were happily blended. The object of the excursion was to make an inspection of the Edison Machine Works, and the delegates to the convention to the number of about 150, left the Grand Central Station, New York, on a special train of four cars at 6 a. m. Breakfast was served immediately after the starting. On arriving at Schenectady at 10 o'clock, the train was shunted into the works by one of the works' locomotives, and piloted by Messrs. Kruesi, Gilmore and Insull, the party proceeded on its tour of inspection. This occupied two and a half hours, a steady walk being maintained during the whole time. Then came luncheon which was served on the train, a very interesting feature of which was that a special cable was run out from the power house to the luncheon car, and upon every table and at other points was an Edison fan motor, current for which was supplied from the power house, where everything is run by electric motors, 1200 horse-power being available. The necessarily rapid tour of the morning was then supplemented by a detailed inspection of any part of the works that any member wished especially to visit, a guide being placed at his disposal for that purpose. The time was thus occupied until about 2:30, when the train was hauled back to the main tracks and left for New York, under the inspection of 3,200 pairs of eyes, that being the number of employees at work in the factories. About 3 o'clock, a choice dinner was served, the discussion of which was hardly finished before the train arrived at the Grand Central. In the evening the delegates were the guests of the local Edison Company, and visited the Madison Square Gardens.

RAPID TRANSIT IN BOSTON.

The commissioners recently appointed to inquire into the merits of the systems proposed for providing rapid transit in Boston, have done some useful work before adjourning for the summer recess. There have been submitted to them a variety of plans and systems possessing various degrees of merit. At the last meeting Mr. Boynton described the bicycle railroad system which bears his name. In the course of his statement he said "All the commissioners heretofore appointed in New York, London and Berlin, have found it essential that there be a four-track road, giving two express and two accommodation lines. The frequent stops, thirty or more in a large city, render rapid transit impossible by means of heavy accommodation trains. But if an additional express train each way be added, stopping only at widely distant intervals, it is manifest that far greater speed is attainable. To build a four-track road in the narrow streets of Boston, overhead, and after the ordinary pattern, would probably be impossible in most places. With the bicycle trains, however, all this is obviated. Only a width of four feet is used by our cars, and the compartments are for four persons only. Ornamental posts, with double tracks, or even quadruple tracks—and yet the quadruple track, no wider than a single standard gauge—will solve the difficulty, which can be solved above ground only by our narrow trains. The two-story cars made of veneer and steel, and seating 108 persons each, are now running in New York between Coney Island and Gravesend on the sea beach route. About twenty thousand trains have so far been sent out without accident of any kind. The trains consist of five cars each, seating 640 persons, and with one and a half minute intervals, which have been found to be feasible in New York, the four-line bicycle road would carry 75,000 passengers per hour. There are fifteen compartments in a two-story car. The entrance is at the side like the entrance to a hack, and the eighteen doors are opened by a single motion. The loading and unloading of passengers are thus greatly facilitated. The cars run upon a single rail of the old T pattern, and are guided overhead by wooden beams. They are safe from derailment, and cannot be blown from the track, nor be obstructed by snow or ice. They move with the smoothness, precision and silence of a bicycle. On a perfect track there is no lateral motion whatever. A

speed of ninety miles an hour has been found to be easily attainable and thoroughly practicable. This speed would bring the suburbs of Boston fifteen miles away, within ten minutes of the centre of the city, if there were no stops to be made, or within fifteen minutes, allowing for five stops." Mr. Boynton then went into the details of construction, urging the use of electricity as the propelling power and showing that a four-track road could be built for about $40,000 per mile.

MINNEAPOLIS STREET RAILWAY COMPANY'S UNDERGROUND CONDUIT SYSTEM.

The electric system of the Minneapolis Street Railway and the St. Paul City Railway Companies is without doubt the most complete and one of the most extensive systems in the world. Among other innovations introduced on these roads has been the burying of the feed wires, thus removing from sight and danger the most obtrusive portion of the overhead structure. These feed wires have been buried elsewhere, but the particular feature of interest that attracts attention in this case is the fact that the wires are drawn *bare* into the ducts.

The conduit is located between the tracks and is built as follows: Two-inch plank, first treated by boiling in fernoline, is used for constructing a long trough of the desired size. This trough is so nailed together so as to be continuous and without joints from manhole to manhole, a distance of 408 feet. The trough is placed below the surface at such a depth that the top is six inches below the paving blocks.

The conduit proper consists of a number of heavy paper tubes of the Interior Conduit and Insulation Company's make. The tubes employed are one inch and one inch and a quarter inside diameter, laid in the trough in ten feet lengths, and separated from each other and the sides and bottom of the trough by rings or spacers. The tubes are made continuous from manhole to manhole by use of a telescopic joint. After the tubes have been properly put in place, pitch, liquified by heat, is poured in, filling the interstices and leaving a series of highly insulated raceways with a solid insulating filling, impervious to moisture around them.

A large amount of this conduit has been in service since September, 1890, and has not as yet developed a single fault. In fact, notwithstanding the conduits have passed through the rigors of a Minnesota winter, recent tests of the various feeders show a maintenance of the originally high insulation resistances, which certainly speaks well for the plan adopted.

With these practical results before them it is not unlikely that others having roads under their charge may do likewise.

TROUBLE IN KANSAS CITY.

An excited crowd of 800 citizens, a large number of them leading taxpayers in Kansas City, Kan., surrounded the city hall across the line last evening and for half an hour frequent threats were made of lynching the mayor and members of the council. These officers were also called upon to resign.

The above paragraph appeared in the Kansas City *Times*, 11th inst. The trouble arose over the proposed purchase by the city of the plant of the Consolidated Electric Light Company. The city council seemed inclined to make the purchase for $340,000, whereas electrical experts employed by the Taxpayers' League estimated it as worth not more than $60,000. At a meeting of the Taxpayers' League the proposed purchase at the first mentioned figure was characterized as a job, and they adjourned to meet as a committee of the whole at the Council Chamber where the council was supposed to be in session. When they arrived there, however, they found the building dark. Thereupon John B. Scroggs, president of the Taxpayers' League, mounted the city hall steps, and addressing the assembled throng, denounced the action of the council in adjourning and declared that it was composed of cowards employed by a corporation, and amid the shouts of "Hang them, Hang them" from the crowd, he added that the taxpayers would either have a hearing before the council or the city would be left without any law makers. "We will either have a hearing," said he, "or run them all into the Missouri river."

THE GEARLESS MOTOR.

One of the greatest drawbacks to the economy of the electric motor has been its high speed, requiring, before it could be applied to most existing machinery, a large reduction involving necessarily considerable losses in efficiency, as applied to the tool, and large expense in maintenance of gears. Where the economy of space was not a desideratum, a single reduction of sufficiently large ratio was at once feasible and fairly economical, but in most cases where machinery is employed, economy of space is scarcely less important than efficiency. This is particularly the case in electrical street car equipment where the available space is exceedingly limited. Until recently the best that could be done in this case, was to employ a double reduction which involved a considerable loss and noise when the gears were new, and ever increasing expense as they became worn. With the introduction of slower speed motors, it became possible to do away with one of these reductions with the consequent advantages of lessened wear and tear, less noise and more efficient transmission of the power of the motor to the car axle.

It is but a step from the single reduction gear to the gearless motor placed directly upon the shaft to be driven, but this step was a long one, and while many essayed it, we have waited until now for its successful accomplishment. Word comes from Cleveland that a model car equipped with the Short gearless motor has made a successful trial trip on the Johnson lines of that city. It is stated that this gearless motor car with trailer, mounted the steepest grades and rounded the sharpest curves in the city with the greatest ease and this too when both were loaded to their full capacity. At one point the trail car left the track. In order to test the new motors the brakes were set tight upon the trail car and the full load drawn, it is asserted, upon the track and around a curve without difficulty. The gearless motor has evidently come to stay, and marks a new era in electrical railroad equipment.

FROM NEWS CENTERS.

NEW YORK.

NEW YORK, AUG. 13.—New York is waiting for rapid transit. The city, however, is just now in the position to realize the full force of the proverb: "Blessed is he that expecteth nothing, for he shall not be disappointed." A meeting of the commission is promised for to-morrow afternoon, when the reports of all the consulting engineers are to be presented. The reports, which will be accompanied by drawings showing every detail of the construction according to each plan, will afterwards be taken up and considered by the commissioners, who will eventually formulate their final report upon them. The commission is understood to have sifted down the various systems presented to them to two, the Parsons and the Worthen. Both these systems involve operations near the surface, and it is difficult to see how either could be carried out without very serious inconveniences, to say nothing of such slight matters as interference with property rights and injury to foundations of houses. The outcome of Friday's meeting is anxiously looked for.

While the fate of New York, so far as the provision for its future means of city and suburban travel is concerned, hangs in the balance, a picturesque story has been evolved out of the preliminaries of the rapid transit scheme. The first steps have been taken in the institution of a suit by William McMahon against James M. Waterbury, in which damages to the extent of $1,000,000 are claimed. These gentlemen represent respectively syndicates or corporations which seek to secure the control of the contemplated rapid transit system. Mr. McMahon's version of the affair, as reported, is that Mr. Waterbury came to him and asked him to exert his influence in securing control of the system for a large syndicate, in which were large owners of landed interests in the upper portion of New York City. After protracted negotiations it was agreed that Waterbury and his associates should deposit $1,000,000 as a guarantee fund, which was to be handed over to McMahon if certain specified plans were adopted. McMahon was to construct the road and furnish the motive power, and the syndicate proposed not to cut through Broadway, but to construct a road which would accommodatingly run through a large part of the property of the syndicate. The bearing of this plan is well suggested by McMahon's remark concerning it which is: "The advantage of having the route planned in this way would have been apparent to their competitors when the bidding began." While these negotiations were going on Waterbury is said to have been approached by the "Whitney syndicate," a powerful body, consisting of two Standard Oil men and others, with the influence of Tammany Hall at their backs. There was no fighting against such a powerful rival, and Waterbury was left in the lurch His proposed suit is to recover what he calculates would have been his profits had the control of the road been acquired as planned by him. McMahon is quoted as saying "I do not pretend that I am alone in this matter; in fact, there are behind me some of the wealthiest and most influential private individuals and corporations in the country."

It has been currently reported during the week that the construction of a rapid transit railroad line in Broadway would vitiate the contract by which the Broadway Railroad Company acquired its franchise. This body has been given certain privileges in that thoroughfare, in consideration of its agreement to pay the city $150,000 annually for the permission to lay and operate a cable system. The report has been officially denied.

Erastus Wiman has been pushing forward with great energy the fitting up of a temporary plant to supply light to the territory on Staten Island which was plunged into darkness by the destruction by fire of the St. George electric plant. It is expected that by Saturday night some of the streets will be lighted, and in a few days current will be supplied to all the lamps that were in use before the fire.

A private exhibition of the operation of the latest form of the Sims-Edison torpedo was given this afternoon at Willet's point. A thirty-one foot machine, designed to carry an explosive charge of 500 pounds of dynamite, emensite, gun cotton, or other explosive, was lowered into the water shortly after 3 o'clock. Within five seconds after the little craft was put in motion, she was making twelve knots an hour. Three minutes later she ran up to thirteen and fourteen knots, and on her homeward run she developed a speed of sixteen knots. Mr. Sims personally superintended the experiments, and unmistakably demonstrated his ability to guide the torpedo in any desired direction. The torpedo carried 13,000 feet of reeled wire, and her engines developed fifty-two indicated horse power. The test was remarkably successful, and the experts who witnessed it were unanimous in the conclusion that the torpedo would have made short work of any vessel that attempted to pass Willet's Point. Mr. Sims is about to leave for Europe where he will exhibit his invention to the representatives of various European governments. G. H. G.

BOSTON.

BOSTON, AUG 15.—The storage battery road between Danvers and Beverly, Mass., is no longer in operation. The company which constructed and equipped the road claims to have performed all and more than it undertook to accomplish in demonstrating the practicability of such a road, but the traffic over the line is not sufficient to warrant its continued operation. The road will in future be operated by horses if at all.

The Electric Road Carriage Company, of this city, Dr. Carter, general manager, will very shortly have running a vehicle propelled by current supplied from a storage battery that is likely to create somewhat of a sensation. The utmost care has been exercised in the construction of this vehicle and its electrical equipment. The designers and builders are sanguine of success.

The Concord, N. H., Land & Water Co. is rapidly developing a movement having for its aim the utilization of the splendid water power on the Merrimac river. Power will be electrically transmitted. Work has already begun on a dam which will give the company a large and constant power, possessing a reservoir extending up stream some thirteen miles, which will be reinforced by a num-

ber of ponds and lakes, including Lake Winnipiseogee. These tributary sources will each be provided with dams by which surplus water will be received during the flood seasons. By these means the power will not only be ample but steady. It is proposed to construct three circuits, four miles long, to Concord; one for power, one for arc lighting and one for incandescent lighting. The undertaking is strongly backed and will, when complete, be of great service to Concord and the surrounding district.

Two ten horse power Thomson-Houston motors have been installed for operating the double draw of the Federal street bridge, Boston. They were started up last Wednesday and are successful.

A quaint but none the less reasonable proposition is contained in an article in an evening contemporary in this city. The writer suggests that the far famed Blue Hills, of Milton, which stand but three or four miles from the limits of the city of Boston, with all their wide stretches of forest primeval shall be preserved as a state demesne, the forests, woods, lakes and rocks being maintained just as nature left them. And since the commonwealth of Massachusetts derived its name from this range of hill country, the word "Massachusetts," in the Algonquin tongue, literally means "The great hills place," the reservation should be known as, "The Massachusetts Forest." The view from the tops of the Blue Hills is beautiful. The writer further suggests the construction of an electric railway from Boston round and round the hills to the very top which would make one of the most picturesque roads in the world.

S. C. Peck, of the Thomson-Houston International Co., is home once more from a long trip through Mexico and Yucatan, where he has done some excellent business for his company.

C. H. Currier, of the firm of J. A. Grant & Co., engineers, is rusticating on Lake Winnipiseogee.

John C. Folger, for several years past in the employ of the Wright Electrical Engineering Co., and Frank Ridlon & Co., Boston, died on Tuesday last, Aug. 11th, of typhoid fever, at his home in Jamaica Plain. Though a very young man in years Mr. Folger had enjoyed a very wide and varied experience in the electrical field and was both accomplished and trustworthy in every way. His death is sincerely lamented by his late employers, as well as by a wide circle of acquaintances.

The New England Telephone and Telegraph Co. is seeking permission to lay all its wires underground in Lynn, Mass. W. S. K.

DETROIT.

Detroit, Aug. 14. The fountain in the Exposition building is to be so arranged as to produce a marvelous effect at the two weeks' exhibition during the first part of September. In the bottom of the fountain an arc light of 6,000 candle power, is to be placed, so arranged as to give silvery scintillations to the sprays of water which will rise to a height of twenty-eight feet. Around the rim of the fountain vari-colored electric lamps will be placed the whole to form one of the most beautiful combinations of water and light ever produced. The great building and grounds will be lighted during the exposition with 350 arc and 1,200 incandescent lights.

During the Grand Army encampment, last week, one of the finest effects was produced by the illumination of the front of the city hall with incandescent lamps. The words "Hail Victorious Army," were produced with lamps arranged to form the letters, and the G. A. R. badge, consisting of eagle, crossed cannon, national flag and pendant star were all vividly produced in appropriate colors by the same method. The figures "1861" were produced in red lamps, indicative of that bloody period, and "1891" in white. Other devices of a less noteworty character were also brought out. It was a beautiful and happy utilization of the subtile fluid upon a scale never before attempted in this city. In this display 2,000 incandescent lamps were used.

Four years ago E. W. Porter, of this city, brought out a gasoline gas-generating machine. It was tested and found defective. Mr. Porter, however, continued his experimental work and lately has been granted patents, both in America and in Europe, on the same principle, which is adapted to a small and comparatively cheap machine, suitable for even private houses, which safely produces an illuminating gas from gasoline. Mr. Porter asserts that his device will prove a formidable competitor of electricity. A machine is expected to be in operation here within a few days.

Dr. Woodward, of this city, inventor of the Woodward storage battery, is now in London, Eng., under contract with Shippey Bros., of King street, and through his suggestion, the Detroit Electrical Works, this week, received a letter from Messrs. Shippey Bros. asking for an equipment, for use in connection with the Woodward storage battery in running electrical omnibuses in that city.

Willard B. Ferguson, vice president of the new company which, a few days ago, purchased the city railway lines—all of which are horse lines—says the overhead wire electrical system will be employed on the Grand River avenue lines as soon as possible. The city, which long ago granted permission to substitute electricity for horses on all lines, will be asked for specific permission in this case, but not for any extension of franchise. The people of Detroit have become so thoroughly indignant over the giving away of valuable franchises in the past on fair promises of rapid transit, without getting it, are now determined to have the rapid transit first.

The Detroit Electrical Works shipped fifteen 40 horse power equipments, on Tuesday last, to Lawrence, Mass., for use on the Merrimac Valley railroad They were mounted on the McGuire cold-pressed steel truck.

C. A. Benton, manager of the railway department of the Detroit Electrical Works, has brought out something new in electrical fan propulsion. By tapping the Highland Park electric railway wire, in front of his door, he has two model fans which have been in successful operation several weeks, each run by a one eighth horse power motor. The discovery that residents along the line of any electric railway may have this comfort at home, and particularly in the sick room in hot weather is of no mean importance.

Frank B. Rae is in Kansas City, Mo., starting up a new electric road known as the West Side road, ten miles long, which has just been completed by the Detroit Electrical Works.

Negotiations for railway equipment are being held in abeyance to a considerable extent just now, as those who design placing orders will await the exhibits made at the annual street railway convention which convenes in Pittsburgh on October 21. V. W. R.

CINCINNATI.

Cincinnati, Aug. 12. Work on the new Edison station is progressing rapidly. The foundations are about completed. The officers of the Edison company state that they will have several generators in operation by the first day of October. The generators will be protected from the weather by a temporary building until the permanent structure is built around them. The conduits of the new Edison plant have been placed under all the principal business streets in the heart of the city, excepting under streets in the territory of the First Cincinnati Edison Electric Illuminating Company.

The Cincinnati and Suburban Electric Railway Company's ordinance, securing it the right of way into this city, has passed the necessary legislative boards and has been signed by the mayor. This ordinance is a modified form of one which was passed by the city boards about a month ago and was vetoed by the mayor.

The Alms & Doepke Company have contracted with the Edison General Electric Company for a 300 light incandescent plant and ninety-four light arc plant, for their dry goods house on Main and Canal streets.

The projectors of the electric road to be built from Fort Thomas, near Newport, Ky., to Cincinnati are experiencing trouble in securing the right of way into this city. This new road will carry passengers for a five-cent fare to and from Newport, Ky., and will be a strong competitor of the Newport branch of the Cincinnati & South Covington Street Railway Company's road. This latter company is making a strong fight against its first competitor.

All bids for the Odd Fellows' temple building have been rejected. There will be about seven thousand dollars worth of electric light wiring, including "dimmers" for theatre and lodge rooms, if the present plans and specifications are followed.

City electrician, Luke Lilley, has been visiting various eastern cities, investigating subway systems.

The subway question has been before the Board of Affairs for some time. Mr. Lilley submitted a list of companies furnishing electric light, power, telegraph and messenger service, this week at a meeting of the B. of A. as follows: *Electric Light and Power Plants:* Brush Electric Light Company, Cincinnati Electric Light Company, First Cincinnati Edison Electric Illuminating Company, Hauss Electric Light & Power Company, Ball Electric Light Company, Jones Bros.' Electric Company, Queen City Electric Company, F. B. Morgan Power Company, A. H. Pugh Printing Company, Cohen & Co., Cincinnati Ice Manufacturing & Cold Storage Company, Arctic Ice Company, Cincinnati Street Railway Company, Colerain Avenue and East and West End Lines, Mt. Adams and Eden Park Railway Co., Oak Street and O'Bryonville Lines, Mt. Auburn Inclined Plane Railroad Company, South Covington and Cincinnati Street Railway Company. *Telegraph and Messenger Companies:* Western Union Telegraph Company, Postal Telegraph Company, Gold and Stock Telegraph Company, City and Suburban Telegraph Company; American District Telegraph Company, Cincinati District Telephone, National Automatic Fire Alarm Company, Merchants' Police, Newman's Watch System, Jones Bros' Burglar Alarm System, and The City Fire Alarm Telegraph System.

Mayor Mosby announced to the Board of Affairs that the Board of Legislation had passed the Garfield Place electric light matter over his veto. He objected to the higher price asked by the Cincinnati Electric Light Company than their bid submitted two years ago, and stated that the park commisioners alone had to do with the lighting of the place. The matter was referred to the committee of the whole.

The Cincinnati Edison Light Company has applied again to the Board of Affairs for permission to open Elm and Vine streets. The matter was referred to the engineer.

The petition for electric lights on West Sixth street from State avenue to the corporation lines was filed. T. J. C.

H. WARD LEONARD & CO.

H. Ward Leonard, the general manager of the Light and Power department, and also of the Intelligence department, of the Edison General Electric Company, resigned on August 3, in order to start an independent electrical engineering business under the title of H. Ward Leonard & Co. The new concern will be an incorporated company under the laws of the state of New Jersey. Mr. Leonard will take with him several well-tried assistants, who have been associated with him in the past, some of them as far back as 1885. Among those who will thus be connected with the company are A. St. C. Vance, E. H. Harrison, C. H. Bloomer and August Munning.

The company will operate specially in a field which is full of promise for the future, namely, the transmission of power by electricity and the application of electric motors to the operation of special machinery, such as is not at present operated by electric motors, or whose operation is subject to improvement by careful attention to the requirements of the case.

Mr. Leonard's experience since 1883, when he became a member of Mr. Edison's first electrical engineering staff, has brought him into contact with every branch of electric light and power work. He has held positions from the lowest to the highest in the exploiting parts of the business, as well as in the construction and in the operation of every kind of electric light and power plants. It is not, therefore, altogether surprising, perhaps, that he should feel willing to resign his office with the Edison Company to take up a line of work which promises so well for one having such exceptional experience.

H. Ward Leonard & Co. will have one important feature of their business which will be entirely unique, namely, an electrical intelligence department. To any isolated plant, the company offers at a subscription price of $25 a year, the privilege of corresponding upon any electrical subject of practical interest. Thus the owner of an isolated plant will be able to secure expert information as to the best methods of operating it, and about any new electrical apparatus or methods, and the principles underlying various devices and the prices thereof. For central station companies, whose queries would go further into steam engineering and methods of distribution, and would cover business questions as to relations with consumers, systems of accounts, etc., the annual subscription charge will be $50.

This scheme certainly is an excellent one and many an electric light man will get several times the value of the subscription price by placing before this company the matters upon which he desires information, data and statistics. As Mr. Leonard created and developed the Intelligence department of the Edison General Electric Company, he has had the broadest possible experience in this line, since information of every character issued to those in the Edison Company has been issued by the Intelligence department of that company. In case expert judgment of the company be desired as to the comparative merits of various competing apparatus or methods, such expert judgment will be given by special arrangement, although the company prefers to merely supply full information under the subscription arrangement, and to allow the purchaser to form his own conclusions.

H. Ward Leonard & Co. will do no manufacturing and will do no supply business, neither will it under any circumstances, act as the selling agents of any concern, directly or indirectly.

The company will, however, act for the purchasr, either as consulting engineers, supervising engineers, inspectors or purchasing agent. When acting in this way they will make the following charges based upon the contract price:

For making preliminary plans, designs, distributions and estimates, - - - - -	1 per cent.
For making final plans and specifications, -	1 " "
For drawing and executing contract on behalf of the purchaser, - - - - - - -	1 " "
For supervising an installation made by another contractor, - - - - - - - - -	3 " "
For inspecting and reporting on the work of another contractor, - - - - - - -	1 " "
For acting on the behalf of the purchaser in making the settlement with another contractor, - - - - - - - -	1 " "
For acting as the agent of the purchaser, from the beginning to the final settlement of a contract, including the making of estimate, plans, determinations, specifications, contract, supervising the installation, final inspection and report, and final settlement, -	5 " "

It will be seen from this complete schedule that the purchaser will be able to obtain the services of this company for any portion of the work, and under terms which are reasonable.

The various parent companies will doubtless welcome the advent in the electrical field, of an electrical engineering concern of this order whose experience and ability is undoubted and who are free from prejudice and have no affiliations of any kind with electrical concerns. Any parent electrical company can refer a prospective purchaser to such a concern as this, with confidence that any opinions given by it to the purchaser will be based on the honest judgment of those thoroughly competent to judge any practical electrical question.

H. Ward Leonard & Company will make a specialty of the transmission of power and the application of electric motors to such uses as necessitate the application of a wide experience in both mechanical and electrical engineering. Such applications of electric motors as are met with in elevators, pumps, hoists, mine tramways, printing presses, etc., are those which this company feels itself especially qualified to undertake under guarantee of perfectly satisfactory results.

INCORPORATIONS.

The following new companies have been incorporated:

Wagner Electric Mfg. Co., St. Louis, Mo.; capital stock, $25,000; promoters, H. A. Wagner, E. G. Ellis, A. Blair, F. Schwedtmann, all of St. Louis.

The Electric Light, Street Railway and Power Company, Creal Springs, Ills.; capital stock, $6,000; promoters, W. DeBolt, C. L. Otrich, W. S. Carroll.

The Brighton Water & Electric Light Company, Brighton, Col.; capital stock, $20,000; promoters, William H. Malone, Willard C. Kidder and James McKeon.

Washington County Electric Light and Power Company, Troy, N. Y.; capital stock, $10,000; promoters, Dagobert Zieser, Troy, N. Y., F. C. Lovejoy, Shushan, N. Y.

The Columbian Electric Light, Power, Heat & Mfg. Co., Jersey City, N. J.; capital stock, $1,000,000; promoters, Julius Hirshfield, Wm. Wright, A. P. Morison, of Montclair, N. J.

The Hughesville Electric Light & Power Co., Hughesville, Pa.; capital stock, $10,000; promoters, Chester E. Albright, M.D., J. Sellers Kite, Frank Cheyney, all of Philadelphia.

The Citizens' Fuel, Light and Power Company, Celina, Ohio; capital stock, $50,000; promoters, A. F. Marsh, S. S. Scranton, Joseph May, T. P. Touvelle, D. Rush, J. M. Lisle, A. L. Bohrer.

The Edison Electric Light & Power Co., Fresno, Cal.; capital stock, $100,000; promoters, Jno. M. Ryan, Louis Gundelfinger, Wm. Fahey, W. Degen, W. McCallum, all of Fresno.

The Kansas Fuel Gas Co., Chicago, Ills.; capital stock, $1,000,000; to furnish electricity for light, heat and power; promoters, Thurston Gordon Hall, Jno. A. Campbell, Jno. H. Carruther.

The Pneumatic and Electric Tool Co., Jersey City, N. J.; capital stock, $300,000; to manufacture pneumatic and electric tools; promoters, E. Baldwin, New York; E. Max, Brooklyn, N. Y.; J. Griffin, Jersey City; A. F. Blackner, Brooklyn, N. Y.

Middletown Electric Street Railroad Company, Middletown, O.; capital stock, $100,000; promoters, H. Knight, H. P. Lane, J. M. Schenck, H. H. Hatch, Murray Schenck, Henry Behrens, W. T. Harrison, M. A. Thomas.

The Kinsey-Wright Electric Elevator Company, Denver, Col.; capital stock, $25,000; manufacturing and constructing electric, hydraulic, steam and hand elevators; promoters, Parvin Wright, S. W. Wright, John C. Fyfe.

Contractors' Supply Co., Chicago, Ill.; capital stock, $1,000,000; general merchandise and supply business and operating steam heat, power, light and water supply plant; promoters, Theo. Burkhard, Judson Lattin, A. W. Cain.

The Buffalo and Williamsville Electric Railway Company, Williamsville, Erie Co., N. Y.; capital stock, $50,000; to operate a street surface railroad promoters, Hascal Taylor, Jno. Satterfield, Robt. F. Parsons, Freeman M. Vilas, all of Buffalo, and Jas. Chalmens, of Williamsville, N. Y.

Portland & Southern Railway Co., Portland, Ore.; capital stock, $10,000,000; business to be prosecuted: build, buy, sell, lease, establish, maintain, and operate all means of transportation and communication, both by land and water, including horse, steam or electric lines; promoters, Frank Sperling, W. S. Mason, Moses Meyer.

LIGHT.

The boiler in the electric light station at Bushnell, Ill., exploded last week, killing the engineer and a farm hand.

The cross which surmounts the Wesley Methodist church at Minneapolis is to be illuminated with fifty-two incandescent lamps.

Worthington, Iowa, at a special election, held a few days ago, voted to bond the city for $10,000 for a system of water works and electric lights.

The bid of the Fort Wayne Electric Company, of Fort Wayne, Ind., for furnishing the electric light plant at Marion, Ind., was $22,490.

News is received of the burning of the light plant at Colfax, W. T. The fire is supposed to have originated in a pile of sawdust and to have been smoldering for some time before being discovered. The plant will be rebuilt at once.

A St. Paul paper says the contract between the Brush Electric Light Company and the city for street lighting expires next year. The Brush people claim that they will now be able to bid so low on a new contract that the city won't consider for a moment the scheme to do its own lighting.

A Des Moines paper contains the following item: "The Edison Electric Light Company, rather than have its wires cut down to allow the passage of the German church which is being moved up Third street, offered to pay $100 toward taking off the roof of the church to permit its passage under the wires. The offer will be accepted."

E. F. Van Ness & Co., of Valparaiso, Ind., have recently purchased two 360-light Edison incandescent dynamos. It is their intention to install a plant to furnish electric lights to customers. The Electrical Supply Company, of Chicago, secured the contract to furnish the wire and other electrical supplies necessary to equip the plant.

They are having trouble at Denver over the electric light question. Ninety-five thousand dollars was appropriated last winter for electric lighting for the current year. If this be all expended for arc lights, as the aldermen have decided it shall be, there will not be enough to go around. It seems that when the appropriation was made it was contemplated using incandescent lights, and the *Republican* insists upon the fulfillment of the original plan, or at least that that portion of the money not yet expended be employed as originally intended.

POWER.

The Fort Madison, Iowa, street railway is to be equipped with electric motors.

It is stated that an electric railway mail service is to be arranged between Moline, Davenport and Rock Island.

The story comes from Richmond, Ind., that "the electric street cars jumped the track and ran two squares on the sidewalk."

The Farwell avenue electric line, of Milwaukee, is nearing completion and the cars, which are already on the ground, are expected to commence running on August 20.

The following statement is made by a rural Iowa paper, and it is hard to believe: "The Electric Street Railway Company at Ottumwa is tearing up some of its lines because they don't pay."

Work was commenced on Friday, August 14, on the extension of the electric railway from Gloucester to Lanesville, Mass., and the work of laying the track will be pushed forward as rapidly as possible.

The Golden, Colorado, Electric Company have decided to hold all bids for the electrical equipment of their road until they can hear from the Short Company, as the idea of a gearless motor is attractive to them.

Having heard reports that the Edison motor was being discarded in street railway work in Minneapolis, ELECTRICITY has taken pains to enquire into the truth of the matter, and as was to be expected learned that there was no foundation for them whatever.

The Woodland Avenue and West Side Street Railroad Company, of Cleveland, has decided, after two years of investigation, to equip its lines with electricity, and will adopt the overhead system already in use on three other Cleveland roads. It is the last large line in the city to give up horses, and when it is equipped, which will be as soon as possible, horse cars will be in use on but one street in Cleveland, and are soon to be succeeded by a cable there.

The electric plant of the San Miguel Consolidated Gold Mining Company is being installed at Telluride, Col. To utilize the water power in the vicinity for the purpose of running the stamp mills of the company's mines a dam was built across the San Miguel river, above Telluride, which falls at that place 400 feet in less than a mile. From the headgate the water is taken through a 4,000-foot pipe, gradually decreasing in diameter from 20 to 12 inches, to the power station, where it is delivered to two six-inch Pelton wheels. The loss in transmission between generator and motor, over a 2½-mile circuit is said to be barely 5 per cent.

The following despatch comes from Racine, Wis.: "The sale of the Belle City Street Railway, negotiations for which have been pending for two months, was finally consummated August 12. The road was owned by Charles Hathaway, of Cleveland, and his son, George Hathaway, who has been the resident manager. The purchaser is C. H. Holmes, who represents a syndicate of St. Louis capitalists, and the price paid is between $75,000 and $90,000. The new company will expend $200,000 in extending the line and putting in an electric system next year. The property consists of seven miles of track, twelve cars, real estate and franchise. The new company takes possesson to-morrow morning and C. H. Holmes will be the manager."

PERSONAL NOTES.

J. P. McQuaid, of the National Conduit Company, New York, was in Chicago last week.

F. S. Palmer, who has been manager of the Ellsworth, Me., Electric Light Company for five years has resigned his position. Mr. Palmer will take a vacation before assuming the duties of another position.

Frank B. Rae, of the Detroit Electrical Works, was in Chicago last week. In a conversation he said: "I have been away from home looking out for our roads almost continually since March. I was in Kansas City a few days ago and saw one of our motors doing work on a grade that I did not think possible."

COMMERCIAL PARAGRAPHS.

Louis E. Hill, manager of W. S. Hill's electrical factory, 133 Oliver st., Boston, is home again after spending his vacation at Rye Beach, and is hard at work.

The Sun Arc Lamp Co., 203 South Canal St., Chicago, finds a large demand for Sun arc lamps, which are adapted to either arc or incandescent circuits. Several large dry-goods houses with plants of their own are installing this lamp.

The Boston *Traveller* says: The orders received by the Thomson-Houston Electric Company during the month of July aggregated more than $900,000 per week and were 25 per cent in excess of orders received during the same period last year.

The newly-organized H. Ward Leonard & Company have had under consideration the occupation of offices in the Columbia Building, New York, but they have finally decided to locate in the Electrical Exchange Building, Liberty Street, New York City.

Peter Claus, late of the Continental Dynamo Company, has identified himself with the Germania Electric Company, as agent in New York City and State, and is located at 63 Broadway. He handles of course the improved Shafer lamp which is rapidly coming into verygeneral use.

The announcement is made that the Electric Engineering & Supply Co., of Syracuse, N. Y., has been appointed general sales agent of the Jenney Electric Motor Co., Indianapolis, Ind., for New York and Canada, and will handle the Jenney motors, power generators and lighting apparatus for that territory.

Merchant & Co., importers, manufacturers and dealers in metals, Philadelphia, have issued a unique souvenir entitled "A Midsummer Night's Dream, being a somnambulistic ramble with Merchant & Co. and their friends the Brownies." The illustrations are artistic and highly amusing. Merchant & Co.'s metal supplies for electrical purposes are favorably known.

Mr. Dean, of the Electrical Merchandise Company, of Chicago, has just closed a contract for the entire equipment necessary for building the new electric street railway of the Citizens Traction Company, of Pittsburg, Pa. This contract was obtained in the face of very strong competition. The company also reports large orders and a bright outlook for the Burton electric heater.

W. R. Mason, general manager of the Electric Merchandise Co., and president of the Burton Electric Co., Chicago, has just returned from a business trip to New York, Boston and Richmond. He reports a steady increase of business in both the companies which he represents. The business of the Electric Merchandise Company has branched out in a surprising manner until there is hardly an electric road in this country that is not doing some business with this popular house.

The Great Western Electric Supply Co. is about settled in its new quarters, 201-207 South Canal St., Chicago. The company reports several large sales for K.K. weather proof wire, for which it is western agent. An agent for one of the large electric companies writes: "I recently had occasion to install a plant in a town where the trees and foliage were very thick; after testing all the leading brands of weather proof wire on the market, I decided that K.K. was best adapted for the work I had to do."

People who have occasion to rise early and who retire at night burdened in spirit lest the alarm clock to which their ears have become accustomed may not arouse them, may now get an awakener that is never failing. The Electric Alarm clock, manufactured by the Monitor Electric Co., 149 Wabash ave., Chicago, rings like fun until the drowsy sleeper gets up and shuts it off. It is a grand thing to insure the early rising of servants. With an electric alarm clock in the house one need never have a late breakfast. The clocks are made in a variety of styles and are surprisingly cheap.

The Jarvis Engineering Co., Boston, is installing engines and boilers in many electric light stations.

The Electro-Novelty Co., 9 Knapp street, Boston, reports a rushing business in its electrical toys, which show very amusing developments of electrical science.

H. Wordsworth, general western agent for the Excelsior Electric Co., reports recent sales of 100 arc lights to the Minneapolis Street Railway Company, and 100 arc lights to the city of Willamette, Oregon.

The Hazelton Tripod Boiler Company, of Chicago, has lately shipped the following boilers of its manufacture: Eight hundred-horse power to Texas; 350-horse power to Tennessee; 300-horse power to Virginia, and 300-horse power to Ohio.

The Germania Electric Co., whose chief offices are in the new Exchange Building, State Street, Boston, manufacturers of the improved Shafer lamp are successfully bidding for popular favor. The company is doing a large business already, and the outlook is particularly promising.

Dr. Robert Amory, managing chief of the Economic Electric Mfg. Co., Boston, and Brockton, Mass., is a busy man these times. Notwithstanding the company's excellent manufacturing facilities which make it possible to turn out lamps in large quantities, orders are accumulating rapidly.

The Crosby Valve and Steam Gauge Company, of Boston, has found it necessary, to keep pace with the increasing demand for its high grade goods, to double its force in several departments and has leased the premises adjoining its own, which are being remodeled in a manner well suited for the company's purposes. The Crosby Company continues to enjoy a large demand for its specialties for use in the dock yards and aboard the war vessels of various European governments.

The Wright Electrical Engineering Co., 196 Summer Street, Boston, is doing a large amount of outside construction work. The company is now installing an isolated incandescent lighting plant in St. Mark's school, Southboro, Mass., the Thomson-Houston system employed, the plant being of 150 lights capacity. At South Berwick, Me., a 200 light plant is being installed for the Newichawanick Co., and the fifth order has just been received from R. C. Dunn, for underground work on his beautiful estate at Narragansett Pier, R. I.

The Safety Electric Light Co., having offices in the Hathaway building, Boston, is a corporation which owns a complete, and what is claimed to be a highly efficient system of train lighting by primary batteries. The system is being thoroughly tested by experts and the company is determined not to place its system on the market until it is practically perfect. To this end one or more cars on the N. Y. & N. E. R. R. have been fitted up and several trips have been made between Boston and New York. Prominent railway men who enjoyed these trips are loud in their praises of the new system. It is reported that several leading New England railway men are likely to become interested as stockholders in the undertaking. Further trips are being arranged.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUG. 4, 1891.

RAILWAYS AND ACCESSORIES.

456,970. Car Propelled by Electricity. Sidney H. Short, Cleveland, Ohio. Application filed Dec. 15, 1890.

457,015. Trolley for Electric Railways. Sidney H. Short, Cleveland, Ohio. Application filed March 29, 1890.

457,016. Electric Car Brake. E. Verstraete, St. Louis, Mo. Application filed July 26, 1890.
This patent describes a system of electrical brakes, the armatures of the magnet being fixed rigidly to the wheel, while the magnets themselves are free to move toward the armature. On the passing of a current through the magnets they will be drawn against the armature and by frictional contact serve for the operation of the "brake."

457,058. Electric Track Signal. Myron W. Parrish, Detroit, Mich. Application filed August 8, 1890.

457,067. Electric Car Brake. C. R. Arnold, Sharon Hill, Pa. Application filed August 21, 1890.
This invention consists, essentially, in utilizing the car wheel to form parts of a closed magnetic circuit from one pole to the other of the brake magnet, so as to constitute a part of a closed magnetic circuit-armature for the magnet.

457,102. Electric Railway Motor. N. C. Bassett, Lynn, Mass. Application filed March 30, 1891.
This patent describes an invention which is principally a water proof enclosing case or frame for a motor and means for protecting the field coils from injury.

457,105. Electric Conductor Support. E. M. Boynton, West Newbury, Mass. Application filed Oct. 17, 1890.
This invention relates to an overhead, continuous electric conductor support for bicycle railways of the Boynton system.

457,135. Railway Signal. Wm. C. Serrell, Bayonne, N. J. Application filed May 18, 1891.
In this invention the batteries are placed at intervals along the line and they are connected in such a manner that the batteries in their normal position oppose each other, and the alarm mechanism upon the engine is only brought into action when the circuit is closed through two trains when they come nearer than the prescribed distance, and this system is also connected with the switch mechanism in such a manner that when the switch is set to the siding, a circuit is partially closed, so that a train approaching the switch or siding completes the circuit connections and indicates that the switch is open.

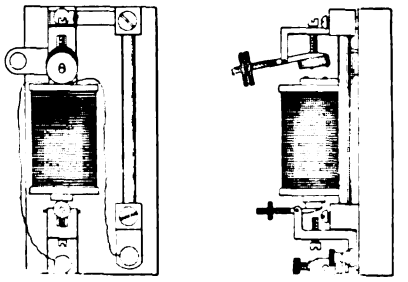
457,240. Electric Railway. S. E. Queatley and J. W. Schlosser, Washington, D. C. Application filed April 2, 1891.
This invention relates to that class of electric railways in which a working conductor extended lengthwise of the road, is divided into short lengths or sections, each of which is fed during the time that the car is passing over it, from a continuous main lead or conductor through an automatic switch.

LAMPS AND ACCESSORIES.

456,997. Coupling for Electric Light Shades. Philip Levison, Chicago, Ill. Application filed March 23, 1891.

457,072. Incandescent Lamp Socket. Waldo C. Bryant, Bridgeport, Conn. Application filed March 9, 1891.

457,141. Electric Arc Lamp. X. Wertz, New York, N. Y. Application filed Dec. 5, 1889.
This invention relates to certain improvements in the construction of electric lamps, which are based on the formation of a voltaic arc located in a glass bulb or globe in which a vacuum has been established, so that the carbon will burn for a considerable length of time and the lamp be applicable for use in the same manner as electric glow lamps, without requiring any forward feeding of the carbons.



PATENT NO. 456,940—MAGNETIC CUT-OUT.

457,151. Coupling for Electric Incandescent Lamps. Isaac J. Flagg, Clinton, Mass. Application filed March 13, 1891.

CABLES AND INSULATORS.

456,979. System for Conducting Electric Currents. E. Britt, Davenport, Iowa. Application filed Oct. 11, 1889.
This patent describes a series of distinct sectional electrical conductors, which by means of pressure, are brought into electrical connection with the main electrical conductors and when relieved from such pressure will automatically become disconnected.

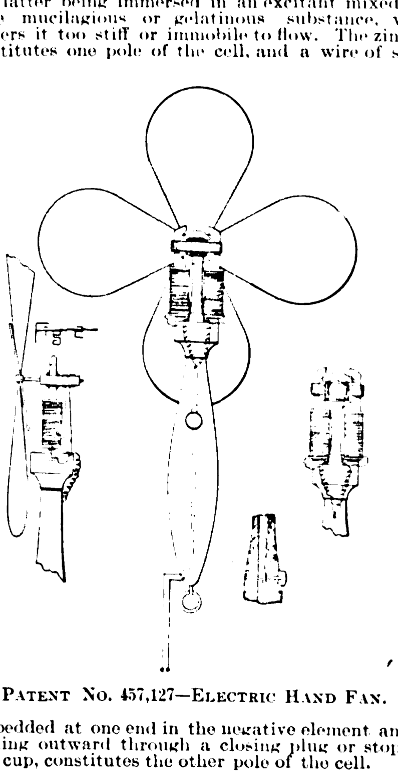
457,106. Electric Conductor. E. M. Boynton, West Newbury, Mass. Application filed Dec. 15, 1890.
This inventi n relates to the use of the overhead guide beams of a bicycle railroad, for the purpose of an electric conductor. By constructing this beam of two separate metallic rails, electrically insulated one from the other, one can be utilized for the outgoing current, and the other for the return current. Suitable contacts, either rollers or brushes, conduct the current from one of the overhead rails to the motor and from the same back to the other rail.

DYNAMOS AND MOTORS.

457,065. Armature for Dynamos or Motors and Method of Winding the Same. Ferdinand A. Wessel, Brooklyn, N. Y. Application filed Nov. 15, 1889.
This invention relates to the manner of winding or applying the coils on the drum-armature of a dynamo-electric machine or motor, and is particularly useful with those armatures to which two sets of coils or bobbins are applied.

BATTERIES.

457,116. Galvanic Battery. J. R. Hard, New York, N. Y. Application filed Feb. 6, 1891.
This invention relates to open-circuit, dry batteries. The improvements are embodied in a cell wherein the positive element is a zinc cup of tubular form and the negative element is a rod or piece of chloride of silver, this latter being immersed in an excitant mixed with some mucilagious or gelatinous substance, which renders it too stiff or immobile to flow. The zinc cup constitutes one pole of the cell, and a wire of silver, embedded at one end in the negative element and projecting outward through a closing plug or stopper in the cup, constitutes the other pole of the cell.



PATENT NO. 457,127—ELECTRIC HAND FAN.

MISCELLANEOUS.

456,940. Electro-Magnetic Cut-Out. S. H. Cobb, Hyde Park, Mass. Application filed Nov. 29, 1890.
The object of the device is to protect electrical instruments against abnormal currents. The device shown is capable of being operated by currents of feeble strength,—as, for example, what is known as "sneak currents"—and which will also receive without injury much stronger currents, thus increasing the efficiency of the instrument by enlarging the limits of current strength within which it will be operated.

457,030. Electric Clock. W. K. Mennis and W. J. Dudley, Everett, Mass. Application filed March 8, 1890.
The invention described in this patent relates to an electric clock of that class in which a time-measuring pendulum controls in its vibration the circuit of an electro-magnet, which in turn actuates an impelling device by which an impulse is given to the pendulum and its oscillating movement thus maintained for an indefinite period of time.

457,090. Rheostat. John A. Mosher, Abilene, Kan. Application filed Nov. 5, 1890.

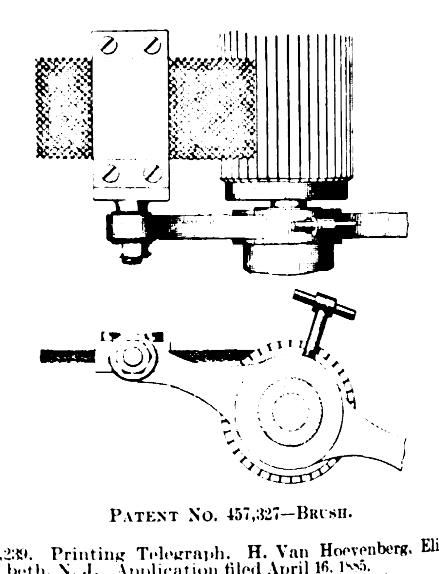
457,109. Socket for Incandescent Electric Lamps. J. Criggal, Newark, N. J. Application filed Jan. 3, 1891.
This invention consists of an incandescent electric lamp provided with a base of suitable non-conducting material, said base having a screw-threaded shank and metallic eyes at the opposite points of said shank, in combination with a socket formed of o spiral retaining wires that engage the threaded shank and the eyes of the same, so as to firmly interlock therewith and transmit the current to the filament of the lamp.

457,110. Mechanical Switch for Electric Systems. C. Daudfenbach, Milwaukee, Wis. Application filed March 3, 1891.

457,127. Electric Hand Fan. W. B. Luce, Boston, Mass. Application filed May 19, 1890.
This invention has for its object to provide a portable fan adapted to be operated by electrical means, thus obviating the necessity of exertion on the part of the user of the fan; and it consists in a fan comprising a handle or holder, a movable fan or series of fan blades mounted to rotate on the shaft of the fan, suitable connection with said motor by which it may be driven, and a circuit closing and breaking device located within or upon the holder, so that the user of the fan may cause the rotary movement thereof to cease at pleasure by the manipulation of a button connected with the circuit closing or breaking device.

457,164. Electric Smoothing Iron. W. Mitchell, Malden, Mass. Application filed Nov. 21, 1890.
This invention relates to tailors' irons and laundry irons which are heated by removable coils or spirals of wire forming a part of an electric circuit.

457,226. Brush Holder for Dynamo-Electric Machines. S. H. Short, Cleveland, Ohio. Application filed Dec. 18, 1889



PATENT NO. 457,327—BRUSH.

457,239. Printing Telegraph. H. Van Hoevenberg, Elizabeth, N. J. Application filed April 16, 1885.
The object of this invention is to provide an instrument capable of printing rapidly from two type wheels, either of which is easily maintained in unison with the transmitter, operates with a small amount of battery power, is not affected by considerable changes in the strength of current, and is controlled by a simple form of transmitter.

457,296. Electric Fence Station Device. David H. Wilson, Chicago, Ill. Application filed August 25, 1890.

457,300. Electric Switch. Waldo C. Bryant, Bridgeport, Conn. Application filed April 8, 1891.

457,301. Electric Switch. Lewis D. Castor, Philadelphia, Pa. Application filed May 20, 1891.

457,327. Commutator or Contact Brush. L. Paget, New York, N. Y. Application filed Sep. 25, 1889.
This invention relates particularly to commutator or contact brushes. To make the improved commutator or contact brush, take woven wire sheet, preferably of copper wire, and cut it into strips of the proper length and width for the brush or contact-strip, the angular relation of the wires composing the woven strips being such that all the individual wires of the entire fabric will bear with their ends upon the commutator strips or contact surfaces as the brush wears away.

457,330. Automatic Brush Shifter for Dynamo Electric Machines. T. E. Adams, Cleveland, Ohio. Application filed Sep. 16, 1887.
This invention relates to automatic brush shifters designed for use more particularly in connection with the Brush constant-current dynamos, and other dynamos of this type.

11,185. Electric Elevator. F. B. Perkins, Boston, Mass. Reissue Application filed June 24, 1891.
This invention relates to elevators of that class known as the "drum elevator," in which the elevator car or platform is raised by winding the hoisting rope or cable upon a drum set in rotation by means of an electro-motor.
This invention has for its object to provide elevators of the class referred to with an electrically-controlled brake mechanism in circuit with the electro-motor and normally operative by the starting and stopping mechanism, as the usual shipper rope to release the brake and permit movement of the car as long as the circuit of said motor is completed, but which becomes inoperative as soon as the circuit of the motor is broken, so that in case of accident to the motor or its circuit the elevator car cannot be moved by operating the starting mechanism.

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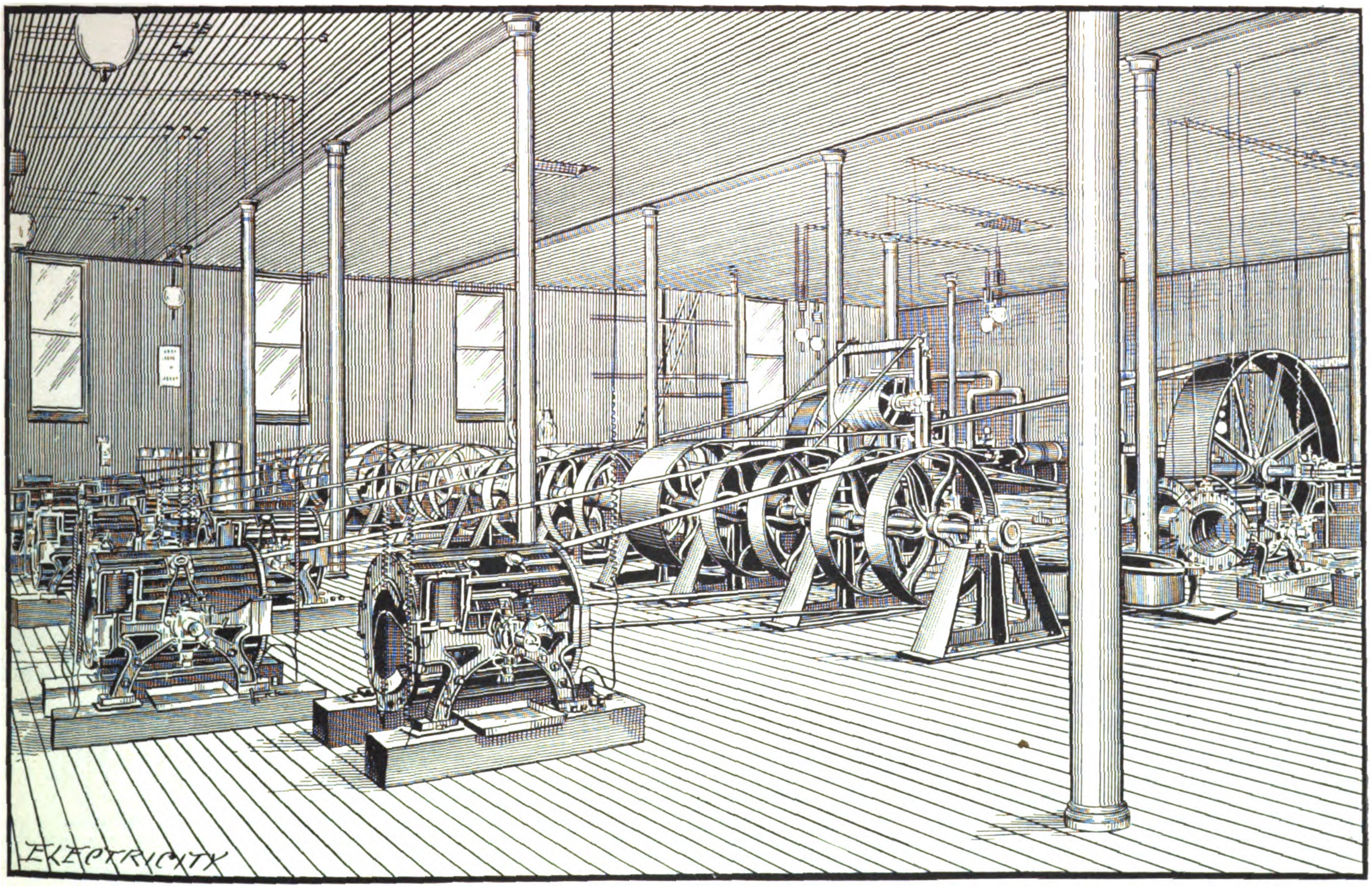


LARGEST ELECTRIC LIGHT PLANT IN CANADA—EAST END STATION OF THE ROYAL ELECTRIC COMPANY, MONTREAL.

(See page 66.)

AN ELECTRICAL CONGRESS AT THE COLUMBIAN WORLD'S FAIR.

BY B. D. F.

Prof. John Perry, F. R. S., appears in print in advocacy of a revision and simplification of what he terms "the confused and annoying systems of electromagnetic units" now in vogue. The new light recently thrown upon magnetism by the investigations of Ewing, Rowland and others and the unexpected practical demonstration of Clerke Maxwell's beautiful electromagnetic theory of light by Hertz, together with the insight which these discoveries are likely to give into the nature of electrical and magnetic phenomena certainly mark an epoch in the history of physical science. It is the feeling among scientific men that much of what has heretofore been regarded as belonging to the transcendental is now so nearly within our grasp as to be only just beyond our reach. It is felt that but a step is required to place within our ken much that we have groped after by what may be termed tentative inductive reasoning.

We do not really know how near we may be to a clear understanding of some of the most hidden secrets of nature. We may be on the very verge of it as many suppose, and the step to accomplishment but a short one.

On the other hand the chasm may be wide and deep. But however the case may be, the avalanche has started and must gain by accretion and momentum as it progresses. The new avenues opened by each new discovery are at once thronged by thoughtful explorers and in the logic of events the end--not the final end of knowledge, for as we reach our present horizon another will rise to view as far ahead of our widened view as is the present boundary to our more limited vision but the end more immediately in view cannot long be delayed of accomplishment.

What more fitting time, what more appropriate occasion and place, than this epoch-making time—the four hundredth anniversary of the discovery of the greatest country on the globe, and Chicago the wonder of modern civilization what more fitting or appropriate occasion than the date of the World's Fair in the New World for a convention of the makers of the newest science, for an interchange of thought, for a discussion of the most advanced theories, for the unification of electrical and magnetic standards, and the simplification and final systematizing of our growing and already inadequate nomenclature!

Would not the bringing together, face to face of the Nestors of electrical science, at this time, so that they might discuss with each other by word of mouth, the burning scientific questions of the day—would not this hasten, even if it did not actually result in, the bridging of the chasm on the brink of which all science finds itself to-day? Would not such a conference be a glorious culmination of the event we are about to celebrate, and would it be less of value to science itself?

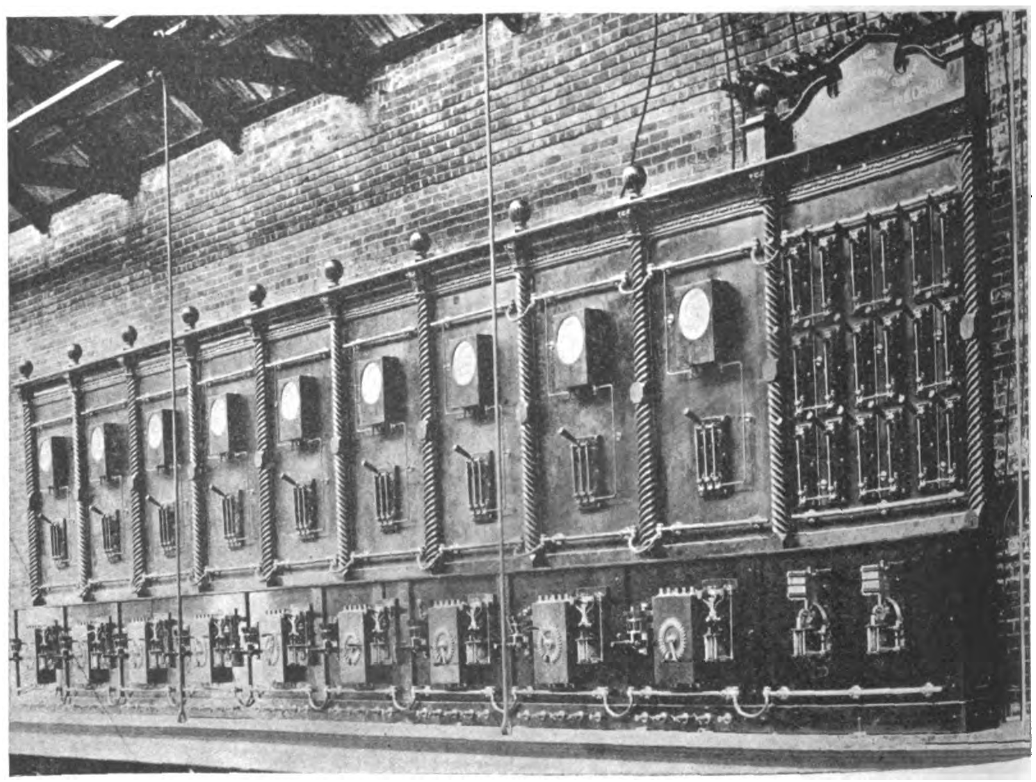
We may look upon the suggestion from another point of view less cosmopolitan perhaps, and more selfish, but still one that should not be lost sight of. Have we not arrived at a point where our contributions to science entitle us to recognition from the scientific world? There are new units to be adopted—new phenomena are being described and these will require names. American patriotism inspires us with the desire that some of these shall perpetuate the names of American investigators. Already the term "henry" has been seriously suggested for one of these. Are there not other names in American history so identified with the advancement of electrical science as to make them appropriate designations of the thing described? Are there not names on our roll of honor so intimately associated with the thing itself as to be almost synonymous in their implication?

Most of the electrical terms now in use, such as the volt, the ampere, the farad, the ohm, etc., are suggestive of the thing only in so far as the men who bore these names were identified with the science to which they belong. Have we not names which can be equally appropriately applied? But that these names may be authoritative and come into universal acceptance it is necessary that they be endorsed by international consent. Where could such international consent be more appropriately asked, or at what time and from what authority, than from an international congress of electricians, consisting of delegates bearing proper credentials from the recognized physical societies in all parts of the world, convened at Chicago or Washington or New York at the time of the World's Columbian Exposition? For the successful accomplishment of this object, preparations should be commenced at once.

The suggestion is offered that the initiative in such a plan should properly be taken by the American Institute of Electrical Engineers; that the matter should be taken up and discussed by the National Electric Light Association, the National Association for the Advancement of Science and the local electrical clubs throughout the country; and that the invitation may bear the stamp of proper authority, the National Academy of Science be requested to officially stand sponsor for it.

ELECTRIC RAILWAY SWITCH-BOARD AT ROCHESTER.

What is said to be the handsomest switch-board in the United States has been placed in the power house of the Rochester Railway Company, at Rochester, N. Y. At present it accommodates nine generators but is to be enlarged. It is constructed of highly finished mahogany with Japanese slate base upon which are circuit breakers, rheostat and main switch. The positive bus bar connects the lower side of all the feed wire switches on the distributing board, which will be in the centre of the completed switch-board. There are, at present, eighteen feed wire cut-out switches mounted on the slate base and these are connected with eighteen trolley wire sections in various parts of the city. It may be interesting to note that the trolley wire system of Rochester is provided with circuit breakers so that an accident to any section may occur without in any way interfering with the others. A rheostat is attached to each machine, also a three-pole Ajax switch for opening the circuit. The switch-board is provided with an ammeter for each machine. Upon the lower side of the slate base is fastened a negative bus bar and about half way between the positive and negative bus bars is the equalizing bus bar. The base of the distributing board is provided with two lightning arresters of the Short Company's make. These are so built that when the arc is broken by the arrester the latter automatically resets itself.



Electric Railway Switch-Board at Rochester.

CALUMET & HECLA POWER PLANT.

A correspondent in Calumet, Mich., writes: The Calumet & Hecla Mining Company is about to erect one of the largest electric power plants in the United States, for running its tram cars, pumping and hoisting machinery. The company has engaged F. N. Bosson, formerly an employee of the Thomson-Houston Company, as electrical engineer. The new works will be in the building that is known as the "old gear house," and it is reported that the Brush system of generators will be used. The lines are now being run and a force of from thirty to forty men is engaged in putting up poles, and stringing wires under Irving Obron, superintendent of construction. A thorough survey has been made of the course of the lines; the poles are placed at equal distances apart, and at equal depth in the ground, and are also stepped, thus avoiding all necessity for the use of climbers. The Calumet & Hecla Company also proposes the erection of a telephone system of its own, and will connect all of its offices, shops, mills and other works with each other, so that communication may be had between all parts of the mine at a moment's notice.

STORY WITH A MORAL.

A story with a moral is going the rounds of the press. It is said that a negro entered a Macon, Ga., street car, and just as soon as he had taken his seat a flash of fire was seen and a cloud of smoke arose from his clothing. The passengers shouted that he had received an electric shock; but the phenomena were found to be due to the fact that the colored man had a box of matches in his pocket, which were ignited when he sat down. The moral is obvious: Don't follow the example of fire marshals, and assume that electricity is the cause of everything that is not explicable at the moment.

According to the tabulated figures of the United States Corporation Bureau of Chicago, 1,139 light, heat and transportation companies with capital stock aggregating $806,077,275 were incorporated during the year ending July 31, 1891.

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Communications relating to subjects within the province of this journal are cordially invited. News notes, descriptions of new devices with drawings or photographs, are at all times desired.

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MR SONN continues, in this issue, his very interesting letter on the Frankfort Electrical Exposition. As seen by him the picture is not very bright, and not likely to excite to a very high pitch, the enthusiasm of American visitors.

* * *

THE storage battery road between Beverly and Danvers, of which so much has been written, and of which so much has been expected, is no longer operated. The fact is mentioned by our Boston correspondent, who writes that operation was not discontinued on account of any trouble with the batteries, but simply because the volume of traffic did not warrant the running of the line.

* * *

THE reunion of the Old Time Telegraphers and the Military Telegraph Corps took place in Washington, D. C., last week. The meeting, as will be seen by our report, was one of unusual interest. The great object of the Telegraph Corps is to secure from the government suitable recognition for its services during the war. The fact that the convention excited so much interest in Washington should certainly help the society in securing a favorable hearing in Congress.

* * *

THE London County Council evidently intends to keep a watchful eye on the electric lighting industry in that city. The body has established a meter testing station where the various types of meters used by the supply companies are to be tested for accuracy. At the station all the meters to be placed in consumers' houses will be tested and calibrated by the inspector in charge. Up to the present time $5,060 have been extended in apparatus for testing purposes, and the station has been fitted up in a thoroughly complete manner. The idea of protecting the interests of the consumers by ensuring the trustworthiness of the meters which record their indebtedness to the electric light companies for many reasons is an excellent one. If the council intends to do the same thing with gas meters, as common fairness would dictate, it will have a rather difficult job on its hands.

* * *

THE possibilities and advantages of electricity are wonderful and constantly increasing. The latest development in this line would appear to be on exhibition at the Frankfort Electrical Exhibition. A correspondent of one of our esteemed contemporaries which styles itself "the only general electrical paper published in the west" writes: "Some conception of it (the power employed) may be formed from the fact that the boiler power, with that of the gas and petroleum motors, is 3,800 horse power, *much of which is again delivered in additional power by electric motors, making in all about 4,800 horse power in use every night.*" Here is a suggestion for the World's Fair Commissioners which, if judiciously followed up, will save more than a million dollars in power alone, besides proving a drawing attraction. We freely concede to our enterprising contemporary the palm for discovering the successful accomplishment of "again delivering" the power by means of electric motors so as to make a gain of 1,000 horse power over the generating capacity of the plant.

* * *

CONSIDERABLE space in this issue is devoted to Montreal, and the National Electric Light Association which is to meet in that city in September. It will be noticed that the most elaborate preparations are making. Certainly the residents of Montreal are planning to make the convention the most interesting in the history of the organization. The frontispiece, this week, is a view of the East End station in Montreal, the largest electric light plant in Canada. A view is also presented of the technical building of McGill College, the scientific headquarters of Montreal. In this structure will be located the department of electrical engineering which it is proposed to organize next month.

* * *

CINCINNATI is now grappling with the electrical subway question, and an ordinance has been approved by the Board of Administration which provides for the awarding of the franchise to the highest bidder, who must make a deposit of $50,000 to be forfeited in case of non-fulfillment of specifications—"not as a penalty," it is stated, "but as a consideration for the loss of time and expense incurred by the city in consequence of such failure to execute the contract," etc. This comes in bad grace from the source from which it does, since the ordinance has already been delayed for three or four months by the dilatoriness of the city officials themselves who would now attempt to punish direlection in others. The city reserves the right, any time after fifteen years, to acquire by condemnation, the entire plant, without compensation for the franchise. This is a remarkable provision, for if the franchise is worth any thing to-day, as is implied by the fact that it is to be put up at auction, it will certainly be worth more in fifteen years, but the city seems to ignore that fact. Furthermore, in view of the facts stated elsewhere, it is probable that the value of the franchise is prospective and capital is not likely to be attracted to an investment which is likely to be confiscated, without compensation, at a time when it has just about been reimbursed for past losses. Another provision is that clay conduits may be used but wooden ones are prohibited. This is showing a strange preference for an inferior article over a superior one. Cincinnati is nothing if not conservative, and her conservatism has been such as to leave her way behind in the race for supremacy among her more prominent western rivals. We hope a more liberal policy in regard to subways will enable the city to acquire a comprehensive subway system. The ordinance, as it now stands, is not likely to accomplish this end, and we hope it may be so amended as to enable responsible persons to bid.

* * *

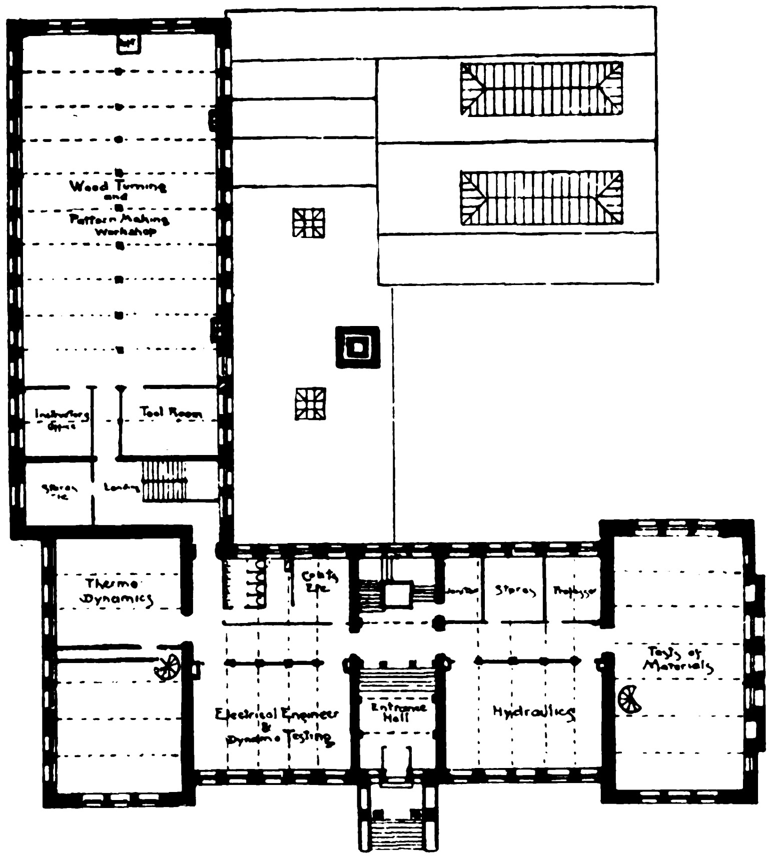
AT the last meeting of the National Electric Light Association, at Providence, the committee on the proper classification of lighting power for incandescent lamps, in its report, described a lamp tester or a simple form of a photometer for use in central stations. The necessity for such an instrument, at the present day, is apparent. As so many different lamps are now on the market, it is not only desirable but necessary to test the accuracy of the guarantees which accompany them. In another column is presented a description of a modified form of Bunsen photometer that can be constructed with little expense. It will enable any person interested in photometric measurements to make tests of efficiency, from which he may derive an idea of the relative values of the several lamps on his circuits. At present most central station managers are obliged to accept the manufacturers' estimates of the watts consumed per candle power by the lamps. With the instrument which we illustrate it would be an easy matter to make tests which would enable the manager to secure such lamps as would increase the earning capacity of his station.

* * *

WE especially commend to our readers and the electrical fraternity generally, the suggestion in another column that the proper steps be taken to secure an international conference of electricians at the World's Fair. The time and place are certainly auspicious, and as there are many questions in electrical science that are now awaiting adjudication it would seem that it were only necessary that the invitation be made by the properly constituted bodies to have it meet with the hearty approbation of scientific men everywhere. Could such a convention be assembled it would do more than any other agency to bring together at the Columbian Exposition the most complete and varied display of electrical apparatus the world ever saw. It would give a prestige to the electrical display which would be wanting without it, and as our contributor suggests, might and ought to result in honoring some of our early investigators by perpetuating their names in the nomenclature of the science to which they have contributed so much. But the steps necessary to this accomplishment should be taken at once, so that the foreign societies, as well as those of our own country, may have time to formulate their views as to what questions should and should not be discussed—as to what changes, if any, are necessary or desirable in the present nomenclature of electricity, and as to what new units are in demand, and as to what they shall be. It is eminently desirable that time be given for a full consideration of all these and other points, so that the delegates may come here with a well defined idea of what it is desirable to accomplish, and how it can best be done. For this reason we advise immediate action. Electricity heartily endorses the suggestions of B. D. F. and believes they are not only timely, but will meet with the approval of all.

MONTREAL, AND THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Canadian hospitality is proverbial, and when the members of the National Electric Light Association meet in Montreal next month they will receive a most cordial welcome. For months the citizens' committee has been devising ways and means for entertaining the visitors, and a synopsis of the plans thus far adopted was contained in the last number of Electricity. A representative of Electricity recently visited Montreal, and found that residents of the city were taking great interest in the approaching convention. Very generally they expressed their readiness to do all in their power to make the meeting successful. They are exceedingly proud of their city, and they were confident that it contained objects of interest which alone would afford the members of the association plenty of entertainment Their city pride is well founded. Montreal has beautiful natural scenery, magnificent buildings and charming homes. Those who visit the city, however, will be especially interested in its curious customs, and the strange contrasts of the French-English metropolis.



Electrical Engineering Department of McGill College, Montreal.

LARGEST ELECTRIC LIGHT PLANT IN CANADA.

To those engaged in electrical work the object of greatest interest in Montreal is the model electric light station of the Royal Electric Company. This company controls almost all the public lighting in the city. Its East End station is the largest in the Dominion, and the sixth in capacity on the continent. Two other plants are located in the company's large building on Wellington street.

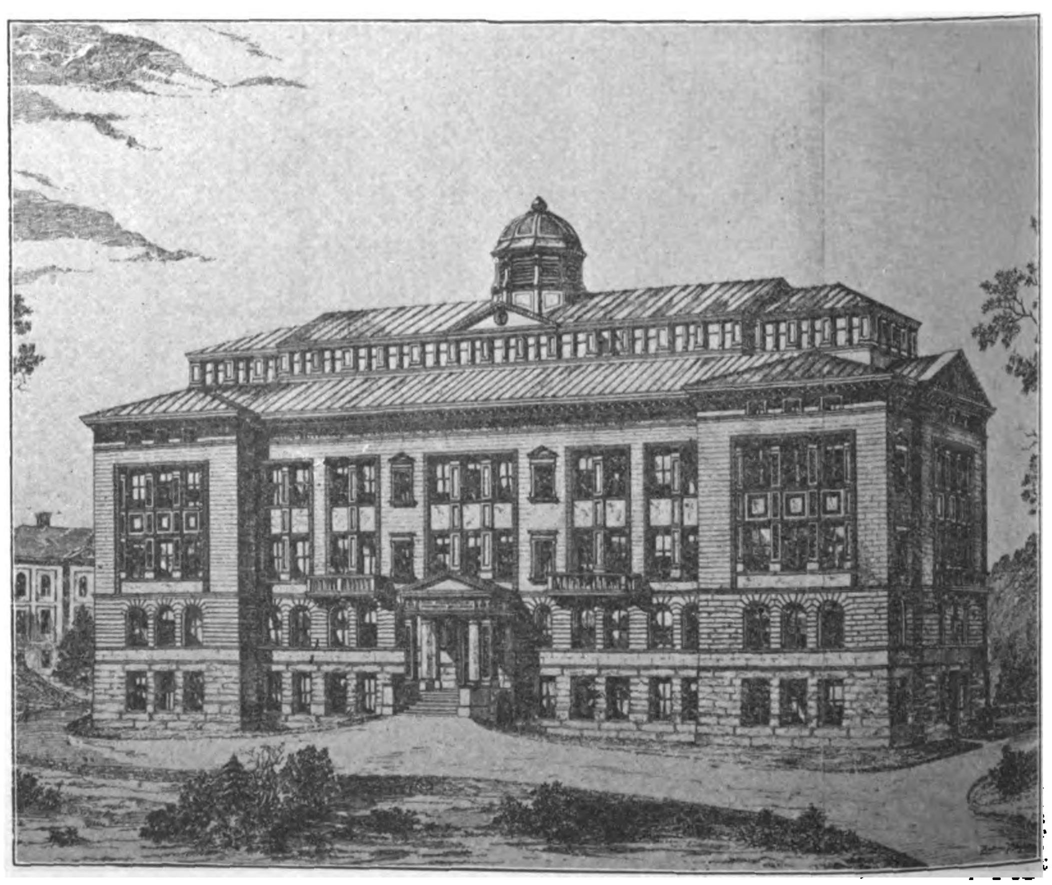
The East End station is located at the corner of St. Ignace and Water streets. The building was constructed as an electric light station, and is admirably planned. The structure is built of stone, and is one story in height. The smoke stack is 125 feet in height, and has a flue area of five and one-half feet. A view of the dynamo room is shown in the frontispiece. There are installed at present 24 arc dynamos of fifty lights capacity each. All of the machines are of the Thomson-Houston type and were manufactured by the Royal Electric Company, which controls the right to construct Thomson-Houston apparatus in Canada. All the lamps are used for street lighting, as the company has a contract with the city of Montreal. The longest circuit is about ten miles. There are two switchboards which have provision for thirty-four circuits. Power is provided by two engines of a rated capacity of 400 horse power each, and one 350 horse power tandem compound condensing engine. All the engines were constructed by the Paulson Iron Works, of Toronto. In the station are condensers of a total capacity of 800 horse power. A stone wall separates the engine room from the boiler room; in the latter department are five Babcock & Wilcox boilers of an aggregate capacity of 1080 horse power. Surmounting the station is an octagon wire tower. Here center twenty-two circuits; each is properly designated by a tag, and is provided with two lightning arresters. Taken as a whole the station is admirably equipped and the service is excellent.

McGILL COLLEGE ELECTRICAL ENGINEERING DEPARTMENT.

A school of electrical engineering has been opened at McGill College, Montreal, and the department has been placed on a firm basis by a liberal endowment from W. C. McDonald. McGill college was founded in 1811, and has over 500 students. It has four faculties: arts, applied science, medicine, and law. In the accompanying cut is given a view of the McDonald technical school as it will appear when completed. In this building the school of electrical engineering will be located. It is hoped that the structure will be completed some time in September. Prof. A. C. Carus-Wilson will have charge of the electrical department. In the sections of the building to be devoted to electrical engineering, which are denoted in the plans presented herewith, a plant for lighting several of the college buildings will be located. It will consist of a 30,000 watt Edison-Hopkinson dynamo driven direct by a Willans engine. The experimental dynamos to be used by the department will be located on the ground floor. They will be operated from a counter shaft by a quadruple expansion engine. The department has already received a number of gifts of electrical apparatus. The Edison Company has donated two 360 light machines. The Thomson-Houston Company has presented an incandescent dynamo, and Whittier Bros. have donated an electric elevator. Among the other American donors are: the Blake Pump Company, the Crosbie Steam Gauge Company, and the Sturtevant Company. The Royal Electric Company, of Montreal, has contributed an arc light machine.

It seems that the convention will actually be in session four days instead of three this year. The proceedings will be begun at 3 P.M., Monday, Sept. 7.

The headquarters of the association will be at the Windsor hotel. Meetings will be held in the large concert hall.



Technical School, McGill College, Montreal.

Mr. Corriveau has received a cablegram from Calen & Bender, of Berlin, stating that they intend to ship machinery to the exhibit.

The North American Phonograph Company has decided to make an extensive exhibition of phonographs at the convention.

It has been decided that the entrance fee to the electrical exhibit shall be reduced to ten cents on certain evenings, so that Montreal workingmen can have the opportunity of examining the machinery.

The work necessary to put the Victoria skating rink into proper condition for the electrical exhibition has been nearly completed, and the first exhibits are expected in Montreal this week. The Edison and Thomson-Houston companies have their work well under way. They are engaged in laying the wires for the transmission of the power from McGill University to the rink. The Fort Wayne Electric Company has made arrangements to transmit its power by an electric generator from the basement of the Windsor hotel.

Special rates of freight have been granted by the Canadian railroads, by which the exhibitors are obliged to pay freight only one way, provided the goods remain the property of the original owner.

A very delightful yachting trip up the beautiful Richelieu river, for the special entertainment of the lady visitors and friends, has been planned by the sub committee in Montreal. The yachts will sail up the Richelieu river, from Iberville to Isle aux Noix, on which is situated the historic Fort Lennox. In their passage up the river the yachts will pass the military barracks now occupied by the Canadian permanent militia under the command of Lieut.-Col. Count D'Orsonnens.

Special rates of railroad fare have been obtained from the various traffic associations on the "certificate plan," and those attending will pay full fare going to Montreal and one-third fare returning, provided they return by the same route. For particulars regarding local transportation the following named gentlemen may be addressed: Geo. F. Porter, Girard Building, Philadelphia, Pa.; R. D. McGonnigle, Allegheny County Light Company, Pittsburgh, Pa.; W. A. Kreidler, Western Electrician, 6 Lakeside Building, Chicago, Ill.; E. R. Weeks, Edison Electric Light & Power Company, Kansas City, Mo.; Jas, I. Ayer, Municipal Electric Lighting & Power Company, St. Louis, Mo.; A. B. Shaw, "Electrical Engineer," 620 Atlantic Ave., Boston, Mass.; C. O. Baker, Jr., 136 Liberty St., New York City.

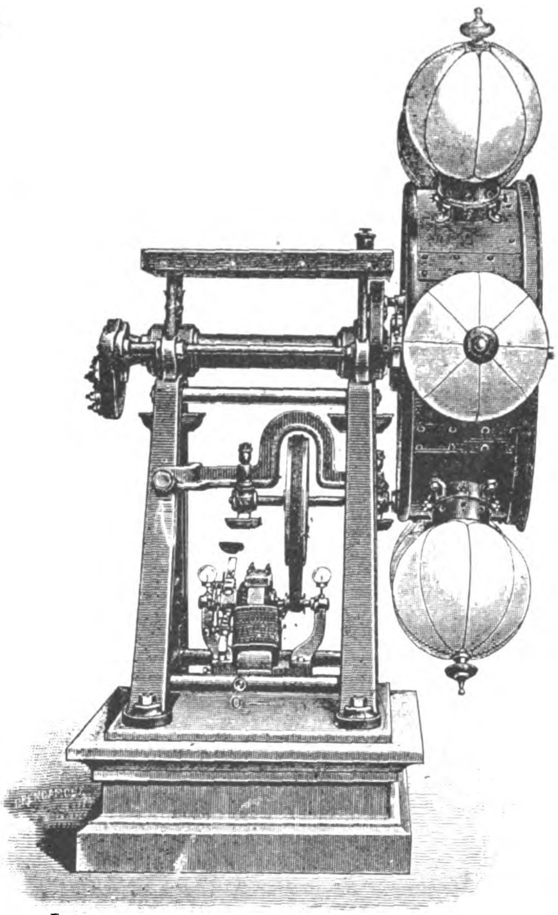
Among those who will make exhibits at the Montreal convention are the following:

American Phonograph Co., Toronto, Can.; Eureka Tempered Copper Co., North East, Pa.; Chas. A. Schieren & Co., New York; Standard Underground Cable Co., Pittsburgh, Pa.; Standard Electrical Time Co., New Haven, Conn.; Standard Paint Co., New York; Fort Wayne Electric Co., Ft. Wayne, Ind.; Electrical Engineering & Supply Co., Syracuse, N. Y.; Eugene F. Phillips Electrical Works, Montreal, Can.; Felton & Guilleaume, Köln, Germany; International Okonite Co., New York; Weston Electrical Instrument Co., Newark, N. J.; The Johns-Pratt Co., Hartford, Conn.; Ball Electric Light Co., Toronto, Can.; Interior Conduit & Insulation Co., New York; Robert Mitchell & Co., Montreal, Can.; Thomson-Houston International Electric Co., Boston, Mass.; Toronto Constr. & Electrical Supply Co., Toronto, Can.; H. Ward Leonard, New York; Dominion Wire Manufacturing Co., Montreal, Can.; T. W. Ness, Montreal, Can.; Edison General Electric Co., New York; Norwich Insulated Wire Co., New York; Excelsior Electric Co., Boston, Mass.; Canadian Electrical Constr., Mfg. & Supply Co., Montreal, Can.; Russell Electric Co., Boston, Mass.; McGill University, Montreal, Can.; La Boiteaux Electric Motor & Fan Co., Cincinnati, Ohio.

The city of Augusta, Ga., owns a water power of 20,000 horse power which is let to manufacturers and others at the insignificant sum of $5.50 per horse power per annum. Much of this is used for electrical purposes, and one establishment which formerly used steam at a cost for coal of $900 per month, furnishing 150 horse power, is now with water generating 600 horse power at a cost of $250 per month and in addition dispenses with two extra men.

ROTATING ARC LAMPS AT THE FRANKFORT EXPOSITION.

Among the most interesting features of the Frankfort Electrical Exposition is a rotating drum, supported on an iron frame work, having six large arc lamps mounted on its periphery, as shown in the accompanying illustration. The



ROTATING ARC LAMPS AT THE FRANKFORT EXPOSITION.

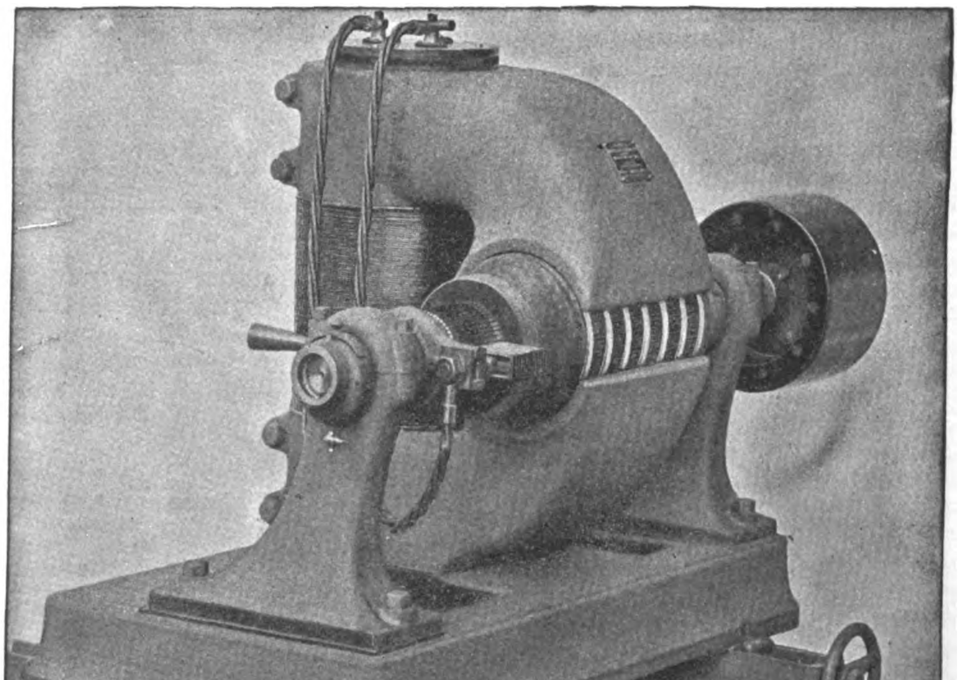
drum is revolved by a small electric motor at its base, and the lamps are kept burning without regard to their changing position throughout the revolution of the drum. The exhibit was designed to illustrate that the lamps are not affected by constant vibration. As it is not affected by jarring, it is claimed the lamp is especially adapted for use on steamboats, locomotives, etc. The lamps, which are manufactured by C. & E. Fein, of Stuttgart, are made to furnish lights of 200, 1000 and 5000 candle power.

ELECTRIC LIGHTS FOR COREA.

The San Francisco correspondent of ELECTRICITY writes: Assistant Engineer T. W. Power, U. S. A., left for Corea, via Japan, by the steamship Oceanic, on the 21st inst. He is on a special mission from the United States government to that of Corea, at the latter's request, to establish a large number of electric light plants. The first matter to be arranged is the lighting of the royal palace at Seoul. After that the illumination of the principal business portion of the city will be attended to. The two forts which flank the city and the sea coast fortifications of Taulsky will be similarly provided for. Mr. Power says that the machinery for all these plants will be bought in the United States, and that the work will be awarded by bids. He calculates returning to San Francisco in four months. Several million dollars will be expended by the Corean government for the purchase of these plants.

JENNEY DYNAMO AND MOTOR.

The illustration shows a twenty horse-power motor which has just been installed in the works of the Central Cycle Manufacturing Company, Indianapolis, Ind. The company expects to install two additional motors, one of twenty horse-power and one of ten horse-power, to complete its plant. The directors of the company, after considerable investigation, decided to use electric power, in preference to steam, because with the former less space was required, and handling of coal and ashes was avoided. The motor was installed by the Jenney Electric Motor Co., of Indianaolis, Ind., and is the same type of machine as used in its dynamos and power generators. Great strength, durability and simplicity are claimed for this type of machines, and it is said that the regulation is instantaneously automatic. The magnetic parts and windings are so proportioned that great variation in load is possible with the least sparking at the brushes. To avoid the continual annoyance of opening and adjusting the feed of the oil cups when stopping and starting the machine, self-oiling bearing are used throughout.



JENNEY DYNAMO AND MOTOR.

A CENTRAL STATION PHOTOMETER.

As electricity enters more and more into competition with gas as an illuminant, the managers of central stations are experiencing the same difficulty that beset the promoters of gas in the days of its introduction. The question then, as now, often arose whether the producer was giving his customer the stipulated amount of light. The problems which this question forces upon companies furnishing illumination are much easier of solution for those providing gas than those supplying electric light. It is the aim of the manager of the electric light station to buy from the manufacturer a cheap lamp; to customers he must furnish an efficient lamp. That he fulfills the latter requirement very few central stations are in a position to prove. But the time is not far distant when it will be necessary for all central station managers to be able to demonstrate by actual measurement that their lamps are efficient.

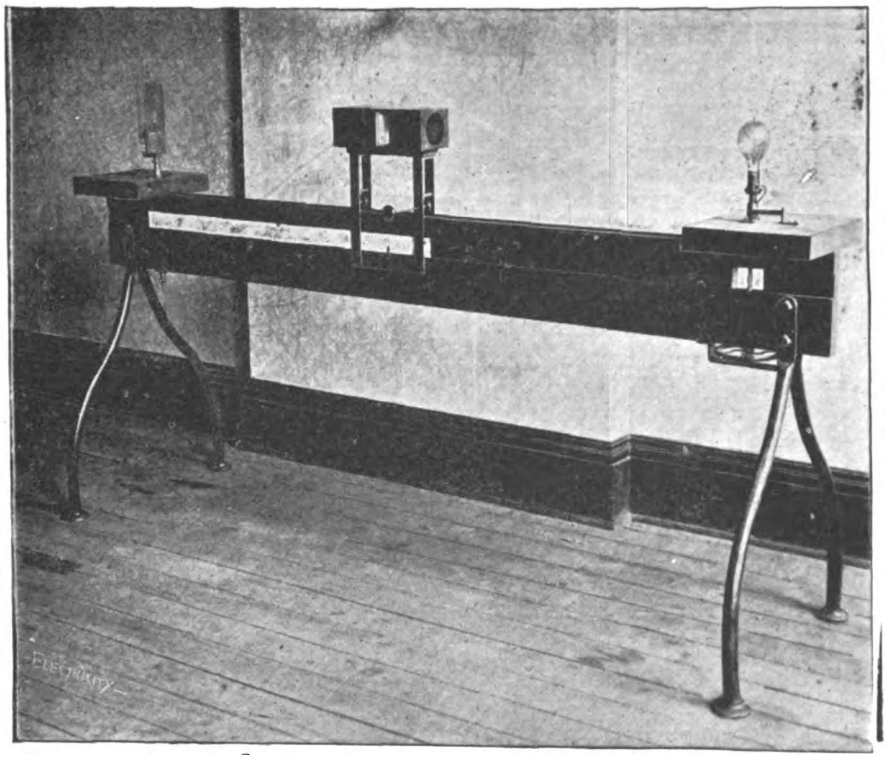


Fig. 1—Central Station Photometer.

With the expensive apparatus now on the market and the limited knowledge of photometric measurements possessed by most central station managers, it is almost impossible to attain such results as would be possible were candle power tests more frequently made. As so many makes of incandescent lamps are now manufactured, the central station manager interested in the financial results of a plant supplying light by means of incandescent lamps should be prepared to make efficiency tests. The apparatus used heretofore has been too expensive or too complicated for making measurements of candle power in an ordinary central station. It is the purpose of this article to describe a modified form of a Bunsen photometer that can be built by any intelligent carpenter, and can be used by a person not versed in the technical descriptions usually accompanying instructions for making photometers.

The method usually adopted for measuring the candle power of a lamp is that of comparing its power of illuminating a screen with the light cast upon the same surface by a known standard of illumination. Upon the arrangement, with reference to each other, of the standard light, the screen and the lamp to be measured depends to a great extent the usefulness of the apparatus. In the greater number of Bunsen photometers the screen is stationary and either the standard light or the lamp to be measured is movable. In the photometer here described the two lights are stationary and the screen is moved toward or away from one of the sources of illumination and the candle power of the lamp to be measured is read off directly from the scale.

To build a photometer of this description a thoroughly seasoned soft pine board 8 feet long, two inches thick and 12 inches wide is cut with a square groove on one side, to carry the different scales to be used. A strip or rail upon which the photometer box travels is fastened to the upper edge of the board. The bar is supported edgewise by four substantial legs made from 1½ inch gas pipe, bolted to the ends as shown in Figs. 2 and 3. The standard light and the lamp of which the candle power is to be measured are mounted near the ends of the bar, and exactly two meters or 78.74 inches apart. A soft pine board 12 inches square and 2 inches thick is fastened to each end of the upper edge of the bar to hold the light in position.

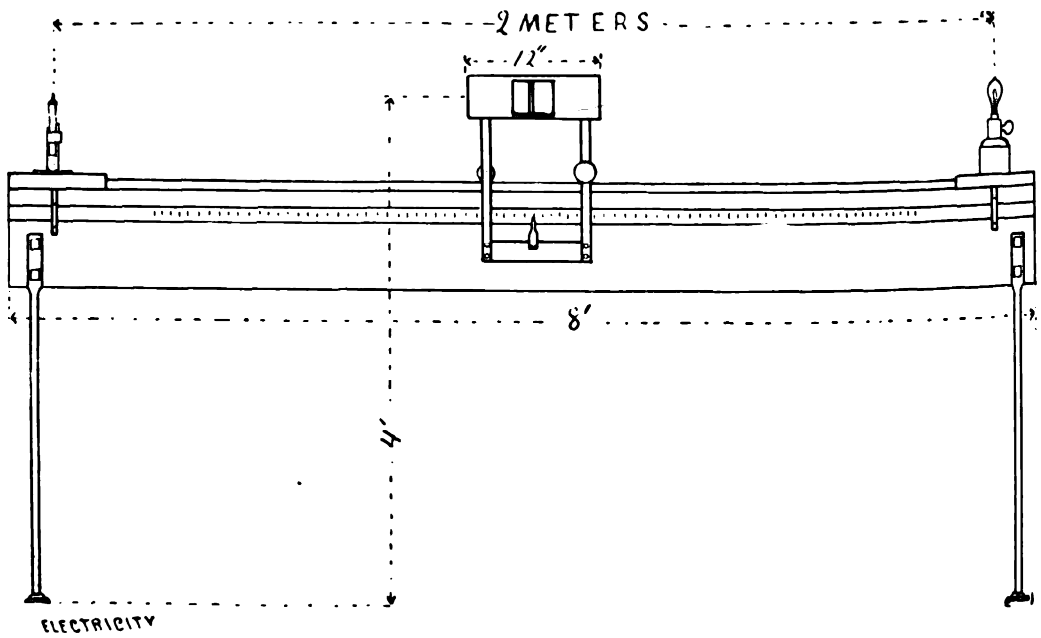


Fig. 2—Central Station Photometer.

The photometer box is made of finished mahogany or other hard wood. Its dimensions should be about 12 inches long and 5 by 4 inches square. A square opening of 2½ inches is left in each side of the box and a round aperature of 3¼ inches in diameter is made in each end. Slots are cut on the inside of the upper and lower cover of the box in which to slip the photometer screen and the two reflecting mirrors as shown at A. B. C. in the cross-sectional view Fig. 3. The photometer box is mounted on a carriage made of strap iron, and supports two small grooved wheels which travel on the track as the photometer box is moved along the bar. The axle of one of the wheels is extended about 6 inches beyond the carriage, and supports on its end a small round knob which is used to move the box forward or backward.

Directly below the screen on the side bar of the carriage is mounted a pointer to indicate on the scale the candle power. The photometer screen is usually made of a piece of paper mounted in a square frame that will slide into the slot *B* Fig. 3. The paper, which should be cream color, has a small grease spot in the center. It usually takes some experimenting to obtain the proper thickness of paper and the correct size of the spot. A more expensive screen, but one that will give better satisfaction, can be made by mounting two square pieces of ground glass in the frame and placing between them a small piece of paper cut in the form of a star or other fancy shape, and about the size of a silver dime. The two reflecting mirrors should be cut just large enough to slide into the slots *A* and *C*, and should be set in the box at an angle of about 65° to the screen.

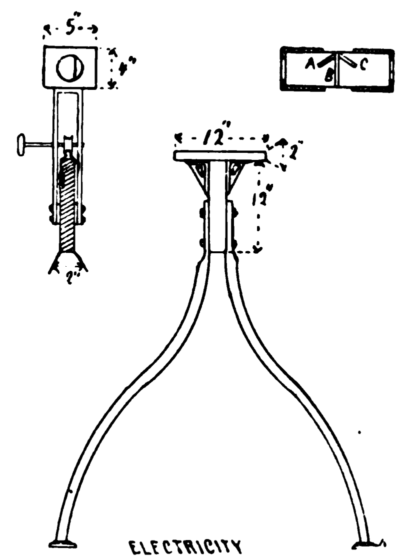


Fig. 3—Central Station Photometer.

The scale can be marked off on a strip of paper glued to a soft piece of wood that will just slide into the slot cut in the side of the photometer bar.

The scale can easily be computed from the formula for points of equal illumination:

$$X = \sqrt{a}\left(\frac{1}{\sqrt{a}+\sqrt{b}}\right)$$

where a is the standard light in candles, b the variable light in candles, X the distance of screen from a. The appended table is calculated from this formula, where two candles are used as the standard which has been found to give the most satisfactory results in measuring 16 c.p. lamps. The distance of points of scale from candles are given in decimal parts of the whole distance between the standard light and the light to be measured. (Factors of four decimals.)

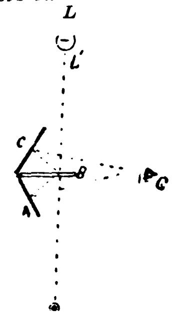


FIG. 4—CENTRAL STATION PHOTOMETER.

CANDLES.	X.	DISTANCE FOR BAR TWO METERS LONG.
1	.5857	1.1714
2	.50	1.
3	.4494	.8988
4	.4142	.8284
5	.3874	.7748
6	.3660	.7320
7	.3485	.6970
8	.3333	.6666
9	.3203	.6406
10	.3086	.6172
11	.2989	.5978
12	.2899	.5798
13	.2817	.5634
14	.2743	.5486
15	.2674	.5348
16	.2612	.5224
17	.2553	.5106
18	.25	.50
19	.2449	.4898
20	.2402	.4804
21	.2358	.4716
22	.2316	.4632
23	.2277	.4554
24	.2240	.4480
25	.2204	.4408
26	.2171	.4342
27	.2139	.4278
28	.2108	.4216
29	.2079	.4158
30	.2052	.4104

The first column represents the candle power of the lamp to be measured when the standard light is 2 c.p., and contains the same figures which are marked on the scale. The second column contains the distance of the screen from the standard light in decimal parts of the whole distance. The third column denotes the distances of the screen from the standard light when the distance between the two lights is two meters, which has been found to be the most practical dimension for central station testing.

The metric system is used because it is much easier to lay off the divisions of the scale in tenths and hundredths of a meter than in decimal parts of feet and inches. If a standard of light other than two candle power is used it will be an easy matter to figure out from the formula another table of numbers for a scale.

Fig. 4 shows the principle upon which the photometer is constructed. Suppose L to represent the standard light and L the light to be measured. When the screen C is brightly illuminated by the light L, the grease-spot will appear darker than the rest of the paper and will be so reflected to the observer's eye at G, by the mirror A. The reflection from the mirror D will show the grease-spot brighter than the surrounding paper. It can now be readily seen that if the photometer box containing the screen is moved to such a position between the lights that all parts of the screen on both sides reflect the same amount of light, the distance of the screen from the lamp can be adopted as a measure of its light and its candle power can be read directly from the scale.

Good results can be obtained by using two *standard candles*, a special form made so as to burn 120 grains of spermaceti wax per hour. But if more accurate results are wanted it is better to use a Methven screen of two candle power as illustrated on the left side of the photometer bar for Fig. 1, or a standard incandescent lamp calibrated to a known candle power. If the mean horizontal candle power is desired an apparatus for spinning the lamp above an axis, as it is being tested, can be arranged as shown on the right side of the cut, Fig. 1. A photometer can be made from this description that will be within the means of any person that wishes to make candle power tests in a laboratory or central station, and will be found in a short time to be an instrument that is as necessary to the successful operation of a station supplying incandescent lights as a voltmeter or an ammeter. The instrument shown in the cut Fig. 1, was designed by Chas. Wirt and was used in the laboratory of the Electrical Supply Co., Chicago, where it was found to give very satisfactory results.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

At last a brighter prospect has dawned upon the Department of Electricity at the World's Columbian Exposition. There can be no disguising the fact that electricians generally and those closest to the throne particularly, have felt exceedingly dubious about the management of this department. In the first place the space allotted to electrical exhibits was deemed entirely inadequate to the prospective requirements, and although the electrical press as a unit, protested, the will of Chief Burnham prevailed and the original plans were adopted. To all such protests Mr. Burnham replied in substance that the electricians didn't know what they wanted.

Strangely, as it seemed, Mr. Burnham, who is an architect, and not an electrician, received support from a majority of the commissioners, and the latter at one time decided that the heads of departments should have nothing to say in regard to the quarters in which their respective exhibits were to be housed, and that they should keep off the grounds. Mr. Burnham, an architect, but neither an electrician nor a mechanical engineer, claimed as his prerogative the right to decide, without consultation with the heads of departments, what engines and power would be required, and even went so far as to enter into negotiations for the machinery.

In fact the hands of all were tied, and none less so than those of the electrical department, and work which could only be properly planned by an electrician of experience, and for which Prof. Barrett would be held responsible, was assumed by one in whose judgment in the premises electricians have no confidence. This seemed a highhanded proceeding and those interested in the electrical department, especially, felt blue at the outlook. It is a satisfaction to note, however, that the powers that be have finally come to a realization of the situation.

At a meeting of the Executive committee last Wednesday a resolution was passed requesting the grounds and buildings committee to pass a resolution to the effect that no contracts for power or light plants should be made by Chief of Construction Burnham, without the approval of the committee on electricity and machinery; and this resolution received general approval from the committee on grounds and buildings.

This action means two things. First, that the committee on electricity intends to know what is going on in matters presumably under its jurisdiction; and, second, that Chief Barrett of the Department of Electricity will have considerable to say about the character of the electric power and lighting plant for the Exposition. It means also that considerable restriction will be placed on Chief of Construction Burnham, and that he will have to secure the advice of department chiefs in reference to this particular matter. The action is right in line with that of the Board of Control to the effect that department chiefs should have almost exclusive jurisdiction in the installation of exhibits. As it is intended that the power plant shall be installed as an exhibit, there is nothing left now for the Chief of Construction to do but advise with the Chiefs of Machinery and Electricity as to the character of the power plant.

"While this action curtails the authority of Mr. Burnham," said a member of the Committee on Grounds and Buildings, "it was not done in a spirit of antagonism. We have an experienced man for Chief of the Department of Electricity, and expect to have an efficient man for the Department of Machinery. We shall have to pay them salaries for doing Exposition work, and we feel that since they are our employes, we might as well secure the benefit of their experience and knowledge."

It was through the wish of the Committee on Electricity that the resolution mentioned was carried, and as that committee thinks well of Chief Barrett, and has practically been championing his cause, it is not unlikely that he will be made the committee's adviser, and so become a most important factor in the placing of the electric light and power plant.

ELECTRICAL SUBWAYS FOR CINCINNATI.

For some months past persons who were interested in the subject have been trying to secure the passage of an ordinance, by the Board of Administration, of Cincinnati, permitting the construction of electrical subways, in accordance with a law passed last winter by the General Assembly, of Ohio. On last Tuesday the long delayed ordinance was presented to the Board of Administration, and having received its favorable consideration, was ordered placed on public inspection in the office of the City Engineer, and made the special order for September 7th, at 2 p. m., for the purpose of hearing arguments and suggestions by any one interested in the construction of the general subway in reference to changing or modifying the plans and specifications.

The law provides that there shall be but one general subway, and that the franchise for building and operating it shall be granted to the highest bidder, provided that the bid be not less than one per cent of the gross proceeds. The telephone and telegraph companies are specifically exempted from going into this subway and are permitted to lay conduits of their own.

The Queen City and Edison companies have decrees from the Probate Court permitting them to lay independent conduits, and some of the other companies have secured decrees from the same tribunal, giving them pole rights. It is a question, therefore, if any but newly organized companies, not now possessing street rights, can be compelled to go underground, and in view of this fact if the ordinance submitted last Tuesday is not amended it seems doubtful if capital will see its way clear to an investment in subways in Cincinnati.

The ordinance provides for an elaborate system of subways, the basis of which shall consist of five trunk lines, running north and south and an equal number running east and west—the central or third of each of these systems of trunk lines to be main trunks, containing not less than thirty ducts in addition to the service ducts and the remaining trunk lines to contain not less than eighteen ducts in addition to the service ducts.

The general arrangement of the system is admirable, and if carried out will give Cincinnati the most complete underground system in the United States or elsewhere.

It also provides that each bidder shall deposit

in bank to the order of the Board of Administration the sum of $50,000, which shall be placed to the credit of the city by the successful bidder, and the latter shall give bond in the penal sum of $250,000 to keep the streets in repair for five years after they are opened, and to hold the city safe against damage of any kind resulting from the operation of the subways.

It further provides that the successful bidder shall commence construction within ninety days after acquiring the right, and within six months thereafter shall have constructed not less than one mile of trunk line and five miles of service line, and one mile of trunk line and one mile of service line every thirty days thereafter.

The rental allowed to be charged is as follows:

Ducts 3 inches in diameter; maximum price, $700 a mile per annum.

Ducts 2½ inches in diameter; maximum price, $600 a mile per annum.

Ducts 2 inches in diameter; maximum price, $500 a mile per annum.

Ducts 1½ inches in diameter; maximum price, $400 a mile per annum.

Ducts 1¼ inches in diameter; maximum price, $300 a mile per annum.

Ducts 1 inch in diameter; maximum price, $200 a mile per annum.

The Board of Administration reserves the right to change from time to time the maximum price fixed above, and also after fifteen years to acquire by condemnation and purchase, if it so desire, the entire subway plant. It is also specified that the manholes shall be of brick and not less than six feet in diameter in the clear.

FRANKFORT ELECTRICAL EXPOSITION.

PART II.

(Special Correspondence.)

In a small structure at one end of the grounds stands a model theatre, constructed by Siemens & Halske. A fee of 50 pfenning (12 cents) permits you to enter a small room in the front of which is a diminutive stage. An elaborate chandelier is suspended from the ceiling of the audience room. When the latter is full, an attendent closes all doors and darkens the room. With a switch board contrivance he next flashes the chandelier. He then pulls up the curtain (not by electricity) and, there stands before you an Alpine scene, with cottage, brook, and snow-capped mountain. In a pompous manner the attendent describes the beauties of the scene, and then he plays his switch board, bringing into incandescence various small lights arranged in the flies so that there is produced the sun rise effect, a sun set, and a moon rise. This is absolutely all that is given for the money, and you leave with a disappointed feeling. This is all that Frankfort has to show concerning the application of electricity to scenic and stage effects.

In an adjoining building, much larger, is the Victoria theatre, also within the grounds. There is presented nightly a spectacular show with ballet. Its elaborate title would lead one to expect something novel in electrical effects. The theatre is crowded at every performance notwithstanding the high price of admission (for Germany). The electrical part of the performance was the lighting of the audience room; and the appearance of ballet girls with wooden models of the telephone tied around their waists. One event in the progress of the entertainment did electrify the American contingent in the audience: an attendant stepped out among the dancers in a tableau and showed up the beauty of the picture by igniting some magnesium powder in a pan which he held!

The Siemens & Halske company has a "mine exhibit." A narrow track runs several hundred feet into an artificial tunnel,—made above ground. On this runs a small motor car with a long, narrow passenger carryall. Hundreds of people were patronizing this novelty. When the seats were all occupied the motor began its work and you were slowly pushed into the darkness and as slowly pulled out again. The motor has no novel features, excepting that there are two seats for the engineer, so that he can change seats every trip and always face in a forward direction. The small headlight of the motor was an oil lamp! Near by the Thomson-Houston people, through their foreign representatives, are running two pumps, and are also pulling a little truck loaded with pig iron or heavy tubing, up an incline of 30° to 40° for a distance of 60 feet. On the crest of this hill, of course, there is a beer garden. In front is a small waterfall, at the base of which is an artificial lake with a naptha launch and a row boat.

The apartment for testing apparatus is a more or less creditable exhibit; by that I mean that it may be creditable to several European exhibitors, but it certainly is inferior, taken as a whole. The proverbial German homeliness of construction shows itself here, too. No American, no Frenchman would put a delicate ammeter or voltmeter in a poorly fashioned, bare finished case. The Germans now make no small pretentions to artistic taste. They show evidences of it in their art work, but their artisans still continue to sacrifice, needlessly, everything to bare utility. Perhaps there will be a change for the better when Nuremburg and Munich adopt the electric light and devote some of their artistic genius to electrical construction.

There is a fine exhibit of electrical toys, with their price marks. It would be a paradise for American boys; a few dollars would purchase an elaborate outfit of batteries, motors, coils and lamps. To visitors, by far the most interesting things in this building are the model of the cable ship, Faraday, and the electric zoetrope. The latter is a slot machine. When you gaze into the interior there passes before your eyes a succession of pictures, taken instantaneously, of athletes vaulting a wooden horse, each being slightly assisted by the hand of the instructor. The whole effect is strikingly life like, much more so than in the ordinary circular revolving zoetrope. The light employed is a small Geissler tube, whose rapid succession of sparks produces by its vividness the peculiar blending of the photographs so that the latter appear as one. This apparatus is also a part of the Siemens & Halske exhibit.

There is nothing in the accumulator exhibit that attracts the eye. The room is dingy, and the exhibit small. The tests have not yet been made. The batteries seem small and light, compared with ours in America. The firm mentioned so often has a small boat on the River Main whose motive power is a battery of accumulators, but repeated visits to the wharf by your correspondent failed to show the craft save at a distance.

A family coach and a sleigh, both with electric glow lamps at the end of the tongue and in the usual places for lamps, attracted no little attention. The accumulators were placed under the driver's seat in both cases. The affair seemed like an ill-concealed attempt to advertise a firm of carriage builders. There is certainly nothing economical or practical in the outfit.

Two long halls remain to be described. In the one is a display of machinery driven by electromotors. Here you can see sewing machines, washing machines, wood carving, glass engraving, soap-making machines, driven by motors, and invest your money, too, in samples. Most of the motors are wholly concealed so that the investigator has no chance to judge of the merits of the various machines. The artisans were usually too busy in making and selling their wares to pay any attention to questions relating to electric motors, and where they had time they knew nothing save that they paid monthly for the power.

The other structure is that in which are displayed conductors and insulators. In this building was seen a most creditable arrangement of exhibits. Many, if not most of them, merited a more favorable site; one monumental piece, some thirty or forty feet in height, being very artistic indeed. It was made entirely of conducting cables and wires and materials employed in their construction, and was crowned with emblematic figures. Thrust away into one end of a side building, it probably is seen by few of the visitors.

In a fortnight an attempt will be made to run many of the dynamos by water power; at least so it is rumored. There will be a convention of city and town magistrates representing all parts of Germany. These dignitaries are to discuss the problem of municipal lighting and transportation. It is expected that all Germany will be aroused by the results of the convention, as very few even of the larger cities have as yet adopted electric illumination. Think of cities like Frankfort, Nuremberg and Munich still clinging to gas.

G. C. Sonn.

REUNION OF THE OLD TIME TELEGRAPHERS AT WASHINGTON.

(Special Correspondence.)

Washington, Aug. 22.—The thirteenth annual reunion of the Old Time Telegraphers' Association and the Society of the U. S. Military Telegraph Corps, took place at Washington, D. C., August 19th and 20th. The largest delegation, about 25 in number, arrived Tuesday evening from New York by the Pennsylvania Congressional Limited, and the Royal Blue train of the Baltimore and Ohio. The headquarters at the Ebbitt House were enlivened by the exchange of greetings and reminiscences, and the hearty welcome of the reception committee. It is the mission of both these societies to preserve the interesting episodes and history of the development of the telegraph in America for civil and military purposes, and the results thus far have been exceedingly gratifying. W. R. Plum, of Chicago, has already performed an important part of this work in his History of the United States Military Telegraph. As president of the military telegraphers' society, he is continuing his labors, with a view to securing suitable recognition of the important services by himself and comrades in the civil war. Mr. Plum was in attendance at the reunion, also Messrs. A. H. Bliss, Crittenden and J. E. Pettit, of Chicago. Mr. Pettit is the secretary and treasurer of the society. The first business session was that of the Old Timers, which was called to order by President George C. Maynard, of Washington at 10:30 a. m., August 19th, when about 75 members and guests were in attendance. President Maynard's address was listened to with great interest. He considered the choice of location as especially appropriate, as it was in Washington that the first telegraph line was established leading to the city of Baltimore. Although it was the government housecleaning time when the president and heads of departments were absent, an old timer would be found on duty in each of their places, and the affairs of the country were moving on with smoothness (which was not alway the case when the city was besieged with politicians. He made a special appeal for the services of women, who had been identified with telegraphy since its inception, when Miss Anna Ellsworth by her influence in behalf of Prof. Morse, was instrumental in securing government aid for the invention, without which its practical development would have been delayed for many years. He believed that the association would be much stronger with the accession of women telegraphers to its roll of membership.

President Maynard stated that he had been much gratified with the good results arising from the sending out of circulars to such of the early telegraphers whose addresses could be secured, inviting them to give a record of their personal services, and the names and present addresses of

their colleagues, where possible. Out of 2,000 distributed, 500 had been responded to, bringing the names of 1,000 not on the existing list, with a prospect of eventually increasing the number to 10,000. A great many have been heard from who were supposed to be dead, and in many instances old friends had been brought into communication with each other who had been separated for thirty or forty years. A few years ago, he said, they had erected a monument to the memory of James Leonard, who was believed to have been the first sound reader, but the returns from these circulars showed that there were more original sound readers than there were birthplaces of Columbus. The same could be said of the first women telegraphers. Owing to the destruction of the collection of relics by the fire in the Western Union building at New York, last year, it was important that they should undertake to make another, which should be placed in some safe place accessible to the public. He suggested the National Museum at Washington as a suitable place, believing that on account of the widespread interest in telegraphic history, a collection of that character should be in charge of the National rather than of any State government. He also thought it necessary that the membership should be increased in order that the important historical matter gathered by the association might be published.

Letters of regret were read from the following gentlemen who were unable to attend: James D. Reid, enclosing interesting historical document; J. W. Kates, J. H. Bunnell, A. B. Chandler, M. D. Woodford, T. D. Lockwood, D. A. Williams, J. C. Vanduzer, D. H. Bates, J. F. Wallick, W. J. Johnston, George Kennan, Emory Cobb, W. P. Phillips, J. J. Wickham, and S. B. Gifford. In connection with the letter from Mr. George Kennan, the celebrated Siberian traveler and author, it was stated that his father, now upwards of eighty years of age, is also a telegrapher.

A letter was read from the local representative of the *Cincinnati Enquirer*, Mr. George Gilliland, stating that it had been the intention of the proprietor of that journal, Mr. John R. McLean, to present each member a silver souvenir of the occasion. Owing to the breakage of the die, however, the contract could not be executed, and was cancelled. To compensate in a measure for the disappointment, he forwarded a check of $50 for the use of the entertainment committee.

On motion of Mr. Plum it was voted that an Historical committee of five members be appointed by the chair to take charge of the collecting and editing of such matter as might be gathered from time to time. The securing of photographs and biographical sketches to replace those destroyed by fire was also referred to the same committee.

The Old Timers' association then adjourned until 3 p.m., and at 2:30 p.m. the society of the United States Military Telegraph Corps was called to order by President W. R. Plum, of Chicago, whose address was an eloquent appeal for justice from the National Government.

The financial report of the society was then read by James E. Pettit, of Chicago, Secretary and Treasurer. The balance from the previous year was $412.46; receipts for the year, $212; expenses, $270.37, leaving a balance of $354.09 on hand.

The joint committees of the two associations reported in favor of meeting at Omaha, Neb., on the third Wednesday of August, next year. The following officers were re-elected: W. R. Plum, President; W. B. Wilson, Vice-President; James E. Pettit, Secretary and Treasurer.

The Military Telegraphers then adjourned, and the Old Timers reassembled at 3:45 p.m. The committee having named Omaha as its next meeting place, Major E. Rosewater, of the Omaha *Bee*, was elected President; Mr. George M. Dugan, of Jackson, Tenn., Vice-President; Mr. W. J. Dealy, of New York, Secretary and Treasurer. The meeting then adjourned.

Thursday, May 20th, was devoted to sight-seeing, and every facility of escort and transportation was supplied by the local committee. Every department of the government has one or more telegraphers on duty who vied with each other in their attention to the visitors.

At 8 o'clock p.m. the members of both organizations and their friends, about 200 in number assembled at the hall of the National Rifles. At one end of the platform a working set of telegraph instruments was connected with the Western Union system, and all through the evening, telegrams of congratulation were received from leading cities in all parts of the country, and at one time the hall was in direct connection with Los Angeles and the City of Mexico.

President Geo. C. Maynard, of the Old Timers, presided at the meeting, and introduced the speakers with appropriate remarks. M. M. Parker, president of the Board of Trade, welcomed the visitors to the city. Referring to the use of the telegraph in war, he said that great battles had been fought and won with the use of the telegraph. The click of the telegraph and the crack of the musket did the business, and the click of the telegraph generally came first. The confidence reposed in the military telegrapher was shown by the fact that Major Rosewater, the new president of the association, was given the countersign of the army of the Potomac, ten days in advance, a trust not even reposed in any of the great generals.

W. W. Burhans, night manager of the United Press, followed with a very interesting sketch of the early experience in telegraphy, and the development of press reporting.

Assistant Secretary of the Treasury Nettleton, spoke of the fact that the original telegraph lines were under the jurisdiction of that department. He called attention to the fact that the invention of the telegraph was perfected in one bound, as instantaneous speed could not be surpassed.

Col. Whittield, representing the Postoffice Department, called attention to the similarity between the telegraph and the mails in their close and confidential relations to the people. He also gave statistics of the first two years of the government telegraph service, in which the ratio of expenses to receipts was 20 to 1 the first, and 2 to 1 the second year.

Assistant Secretary Willits was introduced as an infant in the telegraph business, as he had been engaged in it since July 1, when the Weather Bureau was transferred to the Department of Agriculture. He recognized, however, a difference in infants, some of whom he said were very lively, for instance the infant industries which ran around the halls of Congress when the tariff was under fire.

President W. R. Plum then introduced Assistant Secretary of War Grant, who eulogized the war services of the operators. Being with the infantry, he usually found that when they reached an advanced position, the telegraph had been run ahead and the operator already on duty.

Prof. J. E. Watkins, of the National Museum, presented a strong plea in favor of depositing electrical models and relics in the National Museum, which was visited yearly by over 400,000 people.

A recess was then taken and all present adjourned to the lower floor of the hall where a collation had been provided. Reassembling in the hall an hour later, President Plum called upon various members to give their personal experiences. Among those who responded were Messrs. Safford, Lines, Kerner and Pettit, whose remarks were listened to with deep interest. The capture, and escape of Nancy Hart, a confederate spy, as narrated by Mr. Kerner, was a realistic war story, and an ambrotype was passed through the audience, which was eagerly examined.

Mr. C. C. Hine was to have given his ideas of the "Manager of 1850," to be followed by Mr. W. J. Dealy on the "Manager of 1890." Mr. Hine failing to appear, Mr. Dealy carried out his part with great brilliancy, and showed that the most important part of his duties was to feel that every message was his personal affair, and to instill in his subordinates the same feeling of responsibility. The address was eloquently delivered and made an excellent impression as to the element of personality in carrying on the business successfully and satisfactorily. At midnight the exercises closed with the singing of "Auld Lang Syne."

On Friday an excursion to Mount Vernon occupied the greater part of the day, and upon returning most of the visitors departed for their homes by the evening trains, greatly pleased with their hospitable reception, and the favorable weather which enabled them to enjoy the meetings and entertainments to the utmost. P.

FROM NEWS CENTERS.

NEW YORK.

NEW YORK, AUG. 22. The daily papers of this city are now engaged in a laudable crusade. One of the standing outrages on the business men of New York, who will this year turn into the National Treasury in the neighborhood of $5,000,000 as a surplus, is the infamous postal service dispensed from the general office. As an instance of this a letter can now be sent to either Albany or Philadelphia and a reply be received in less time than the same service can be given to send to and from some of the Harlem River and Brooklyn districts. It is to remedy this state of things that the local papers are now vigorously agitating. The solution of the problem of quick deliveries and collections is admittedly difficult, and though many suggestions have been made, no decision has yet been arrived at with regard to the selection of a rapid and effective service. Many are of the opinion that the pneumatic tube system will furnish sufficiently rapid transmission between the main post office and the tributary stations, but the feeling has been growing that some method of electrical transmission will finally be adopted. It is somewhat humiliating to New Yorkers to know that an infinitely better postal system than their own has been in use, not only in London, Paris, Vienna, and Berlin, but in such cities as Manchester, Liverpool, Glasgow and Edinburgh, for nearly a quarter of a century, and yet to place New York on an equal footing with these cities would cost but 10 per cent of its yearly surplus.

A prominent New Yorker is engaged in developing some entirely new effects in ship electric lighting. This gentleman who, while possessed of expensive tastes has the wherewithal for their gratification, has conceived the idea of making his new yacht one of the most perfect crafts afloat, and in addition to various applications of electricity throughout the ship, the illumination is entirely electric. The plant will consist of 135 16 candle power incandescent lamps besides a search light of 2,000 candle power. At night the yacht will be "dressed" with electric lights, a line of which will run around the tops of the cabins and from stem to stern above the middle of the deck. The rest of the equipment of the boat is carried out on the same unstinted lines: a powerful fan gives the boilers forced draught and ventilates the ship, and a complete water distilling and refrigerating apparatus is provided. The pipes are so arranged as to cool the vessel in summer and heat her in winter, and the electric motor will be brought into requisition for various purposes.

The question has been raised whether the Broadway and Seventh avenue Surface Railway will be relieved from its present payment of $150,000 a year to the city if the proposed tunnel railway under Broadway be constructed. As the resolution of the Common Council in connection with the granting of the franchise of the company, explicitly states that the payment of this sum to the city is to continue only so long as there are no additional railroads on Broadway, it certainly looks as if the company had the best of the situation. The strength of its position is shown by the argument that if it should secure the franchise for the tunnel road under Broadway, it would be absolved from its obligation to pay the

$150,000 annually just as much as if some other company secured the franchise.

Quite a party of electrical men gethered, on Tuesday afternoon, at Astoria, on the invitation of W. M. McDougall, to witness the trial of the storage battery car equipped on the McDougall system. The prominent feature in this car is the method of suspending the motor. This is supported on a frame of iron I beams, the two rear ends of which are supported on the rear axle, close to the journal bearings. The front end of these beams, however, are bent, so as to come within six inches of each other, and they are then joined to a swivel bearing, which rests on the front axle. By this method of suspension the motor has a free movement, and this was specially noticeable during the trip, as the car traveled with great ease, and entirely free from disagreeable noise and vibration. The road on which the car is operating, the Steinway & Hunter's Point Railway, is of a character to test the capabilities of the car severely, as there are a great number of steep and long grades to climb. Throughout the trip the car behaved admirably, and its running elicited nothing but favorable comment from those present, besides reflecting great credit on the electrician of the road, Townsend Wolcott. G. H. G.

BOSTON.

Boston, Aug. 22. This city is well supplied with street lights, which are furnished by the Boston Gas Light Co., the Boston Electric Light Co., the Suburban Electric Light & Power Co., and the Edison Illuminating Co. The following statement shows the number of lamps of all kinds in use on the 15th of December, 1890, as compared with 15th of December, 1889:

	1889.	1890.
Gas	9,878	9,247
Oil	3,006	2,957
Large Gas Lamps	80	35
Naphtha	48	99
Electric	798	1,125
	13,810	13,463

It will be seen that while the total number of lamps has decreased the electric lamps have largely increased; naphtha, too, shows a large increase. Boston is not far from being one of the best lighted cities in the Union.

It is a great disappointment to all who were present at the Providence Clambake that the photograph taken of the group was anything but satisfactory. It is whispered that the funny trio who hitched up the bottomless apple barrel as a camera stole the photographer's thunder and got away with the best negative.

It has been going the rounds of the papers that the Blake transmitter patent had already expired in England. Such is not the case. The patent runs until Jan. 20, 1893. The telephone patent that has expired in England was one granted to T. A. Edison on July 30, 1877, and expired on July 30, last. This expired patent, however, did not affect the transmitter patent.

Now that the storage battery cars have ceased to run between Danvers and Beverly, Mass., it is likely the Naumkeag Co. will extend its overhead system to Beverly.

West End Railway stock is in brisk demand in financial circles in Boston by reason of the fact that the electric system has proved so economical. Though the big power house, nearly completed, has cost well nigh double the estimate, the company is in a position to pay for it easily, and to extend its electrical equipment as well, and as the electric system can be operated for 50 per cent less than horses, larger net earnings than ever are confidently looked for.

Work on the Interstate Street Railway has been began at Attleboro, Mass., the Clemons Electrical Manufacturing Co., of that town, having the contract. The road will cover quite an extensive territory and connect North Attleboro, Attleboro, Pawtucket and Providence.

W. B. Prindle, chief of the advertising department of the Thomson-Houston Electric Co., is again at his office after a brief vacation.

H. H. Eustis, president and electrician of the Eastern Electric Cable Co., is rusticating at Newport, R. I.

W. P. Stanwood, treasurer of the Redding Electric Co., Boston, formed one of the recent clam bake party at Providence, for the first time. His experience on that occasion has prompted him to express the opinion that for hearty good fellows who know how to thoroughly enjoy themselves, the electrical fraternity stand way ahead.

A big street railway deal, involving the two existing street railways in Brockton, Mass., has just been consummated in that city. The Industrial Improvement Society, of which ex-Governor Oliver Ames is president, purchased the East Side Railway, which is an electric road, about a year ago. Since it changed hands extensions have been made in various directions, the new track to Whitman being the most important. Franchises were owned by the new purchasers, also for new roads between Stoughton and Brockton, North Easton and Holbrook, but no work as yet has been done on these lines. In order, however, to make the East Side system a paying undertaking and to prevent competition, negotiations were entered into by representatives of the Industrial Improvement Company with a view to purchasing a controlling interest in the Brockton Street Railway, which is a horse railroad, extending from Brockton to Randolph. Colonel George H. Campbell, vice president of the Industrial Improvement Co., and A. A. Glasie, treasurer of same company, held a conference a day or two ago with W. W. Cross, president of the horse railroad, the heaviest stockholder. The latter soon agreed to sell his interest in the road and the transfer will be made during the next few days. Meantime the two roads will be operated separately until the state legislature convenes, when authority to consolidate will be sought. The importance of this deal to Brockton, the shoe metropolis, will be apparent, when it is stated that it means connecting all the surrounding towns with Brockton, by electric railways, and sooner or later Boston itself will be reached by the same means, though the two cities are over twenty miles apart. The Brockton road will be equipped by electricity immediately at a cost of $200,000. The citizens are elated at the bright prospect.

The Tropical American Telephone Co., of this city, has just shipped a large consignment of telephones, switchboards, and other electrical supplies to Maracaibo, Venezuela, where this company is erecting an exchange.

W. Stiles, of the Thomson-Houston Electric Co., is about again after his recent attack of rheumatism and erysipelas. W. S. K.

SAN FRANCISCO.

San Francisco, August 18. There was a lively time at the annual meeting of the California Electric Light Company on the 11th inst. Alexander Yoel charged the directors with speculating in the stock of the company, and with illegally declaring dividends when the company was in debt. At Tuesday's meeting, it is alleged, though three-quarters of the capital stock was not represented as required by law, the dividend was declared, and it was proposed to transfer the property of the company to the Edison General Electric Light Company. This proposition, in a voluminous written form, was only partly read. Briefly, it provides that the Edison Company shall assume the bonds and the Electric Light Company shall pay off all the indebtedness, the present shareholders being given for their interest shares in the Edison Company. The acceptance of the proposition is considered very doubtful.

The State Board of Equalization reports glaring discrepancies in the assessments of some of the biggest firms and corporations in the city. The total shortage is placed at $60,000,000. Among those called on to explain the alleged undervaluation is the Pacific Telephone Company. On the present list it is assessed at $86,227.

The success of the Oakland and Berkeley electric road has encouraged several like projects in this city and suburbs. Work is being actively pushed on the new San Francisco and San Mateo railway. It is expected that the first car will be running by November 1. At present it has twenty miles of track laid through the southern portion of the city. The terminus of the road is a subject of speculation. The company declares it is trying to reach San Jose, fifty-six miles south. Rumor has it that the road is seeking franchises all the way to San Benito county. For this reason many people hold that the Santa Fe Company is behind it and will eventually use its road bed as an entrance to the city. The Southern Pacific people say confidently that the road is to be built only far enough to make it an alluring bait for some railroad company; that it is merely a speculative enterprise. The bid for the power-house has just been let at a cost of $31,000. The concrete beds for the two power engines to rest on will cost $8,000. Contracts have also been let for the pumping and shafting to supply the power house with water. Thirty cars, "double deckers," lighted by electricity, will be ready for the line next month. The trolley overhead system will be used. The plant will cost $100,000.

George W. McNear and his associates, who were so successful in constructing and operating the Oakland electric railroads, have obtained a large block of the stock of the North Beach and Mission railroad, (horse cars) this city. The stockholders will meet September 23d, and a strongly backed proposition will be made to reconstruct the road on a five foot gauge for electric motive power. A resolution will be offered authorizing the issuance of $1,000,000 worth of bonds for the work. Within six months from the date of the meeting it is expected that electricity will cause the retirement of all horses on the Folsom street cars.

Colonel Fred Crocker, of the Southern Pacific Company, says that a well equipped electric road will in all probability be running out Broadway, Telegraph and Humboldt avenues, from Oakland to Berkeley, within eight months. Mr. Clement, of the Southern Pacific Engineering Department, has been east for some time looking into the various electric railroad systems.

The report is current that the Oakland and Berkeley Electric Railroad will soon begin the construction of one of its branch lines. B.

H. WARD LEONARD & CO.

The prospectus of H. Ward Leonard & Co., of New York, has just been issued. As the company is formed on rather novel lines the following abstract from the circular is presented:

"This company has been organized with the special object of undertaking work involving the necessity of a wide, comprehensive experience in the electrical field and such a knowledge of electrical, mechanical, chemical and mining work as is necessary for the intelligent application of electricity to new uses and such as does not at present exist outside of large electrical companies. It is well known that the best experts of the large companies are kept so busy on profitable routine work, that they are not so readily available to develop a new application of elecricity, as would be similar experts whose work would lie entirely in that direction. In other words, the best electrical engineers are largely occupied with planning and constructing electric railway plants, arc light plants and incandescent plants and find little, if any, time in which to give attention to the development of new applicaplications of electricity.

"A prospective purchaser to-day who wishes power transmitted great distances and then utilized as far as possible in a good sized town, finds himself confronted by conflicting statements as to what is possible and necessary and also finds that the parent companies, whose shops are full of profitable standard work, do not exert themselves to secure a contract involving the services of their best engineers at great distances from home, and upon plants no two of which are likely to be sufficiently alike to allow of duplication as in railway and lighting plants.

"Furthermore the parent companies are primarily manufacturing companies and do not do construction work except for the purpose of insuring the sale and proper installation of their manufactured goods, and they have, of course, no interest whatever in selling or installing the goods of a rival manufacturing company.

"We believe that all first class manufacturing companies will be glad to have in the field an electrical engineering concern who will always recommend and install their apparatus for purposes to which it is the best adapted and especially if they have confidence that the installation will be one which will reflect credit upon their apparatus, which confidence we believe will not be lacking. The various supply companies having special devices of undoubted merit, will be glad to have a concern in the field who will use that device in the market which is the very best for its purpose, and who have no agencies of any kind for the sale of competing devices, and hence no possible prejudices.

"The various electrical construction concerns are paying attention principally to the construction of street railways, arc light plants, and incandescent plants of types which have become standard because of the large number which have already been installed and because the conditions are so nearly the same in different plants of such kinds. Hence it seems evident that our work will be of a character such as will not be in conflict with the various interests in the electrical fields to-day.

"Our policy will be operated as far as possible in harmony with these existing electrical interests as will be indicated by the following lines of policy: 1st. We shall have no exclusive relations with any electrical manufacturing company. 2d. We shall take no selling agencies for anything. 3d. We shall do no manufacturing. 4th. We will undertake any electrical engineering work within our means and in any manner consistent with the above. 5th. We shall endeavor to operate so far as possible in the newest fields of electrical engineering, and shall not make any special effort to secure construction work which is merely imitative in character. 6th. We shall endeavor in every way to be non-partisan, and to work in perfect accord with all electrical manufacturing, selling and supply companies.

"H. Ward Leonard & Co. is a corporation organized under the laws of the State of New Jersey. Its present authorized capital is $200,000. The original subscription was for $50,000, $32,000 of which was subscribed by the incorporators. It will be noticed that the revenues of the company will be of a character such that comparatively little capital will be required considering the net revenue. The shares of the company are $100 each. The present stockholders include some of the most prominent officials of the various leading electrical companies. None of the stock of the company will be issued for anything but absolute cash or its equivalent, and every shareholder

is on exactly the same terms as every other shareholder. That is, there will be no issuing of stock for contracts, patents, franchises or similar considerations having an indefinite value. In case you desire to become a subscriber to the stock, please notify us to that effect as soon as possible, as the stock is likely to be over subscribed and the apportionment of stock will later be placed on or before October 1st, 1891."

INCORPORATIONS.

The following new companies have been incorporated:

The People's Electric Railway Company, Sandusky, Ohio; capital stock, $100,000; promoters, Jacob Kuebeler, A. W. Prout, W. H. Glicher, Geo. Barney, Watson Hubbard.

The Armour Electric Light, Fuel & Power Co. of Illinois, Chicago, Ill.; capital stock, $5,000,000; promoters, Martin C. Burt, Allan T. Bennett, Clarence O. Scudder.

Flint Creek Electric Power Company, Butte, Mont.; capital stock, $25,000; promoters, Thomas T. Baker, Jos. H. Harper, Butte, Mont.; Alden J. Bennett, Virginia City, Mont.

Grand Haven Electric Light & Power Co., Grand Haven, Mich.; capital stock, $50,000; promoters, Oscar C. Mackenzie, Isaiah T. Greenacre, of Chicago; Chas. C. Macomber, Grand Island, Vt.

Norfolk Street Railway Construction Company, Norfolk, Nebr.; capital stock, $25,000; to build an electric street railway in Norfolk, Nebr.; promoters, N. O. Whyman, C. A. Mast and R. A. Stewart.

The Canada Gas and Fuel Company, Chicago, Ill.; capital stock, $5,000,000; to manufacture gas and electricity; promoters, Thurston Gorden Hall, Patrick Dowling, Thos. N. Daucey, Loftus E. Daucey.

The Chicago & Evanston Electric Railway Co., Chicago, Ill.: capital stock, $500,000; to construct and operate a passenger street railway system; promoters, Jno. Lewis Cochran, Frank S. Gorton, Delaney H. Louderback.

Georgia Electric Light Company, Atlanta, Ga.: capital stock, $800,000; H. M. Atkinson, H. E. W. Palmer, H. T. Inman, W. R. Joyner, Morris Branden, Geo. R. DeSaussure, J. H. Porter, Burton Smith and Walker P. Inman—all of Atlanta, Ga.

D. & D. Electric Manufacturing Co., Minneapolis, Minn.; capital stock, $50,000; manufacture and sale of electric motors, dynamos, etc.; promoters, Gilbert Donaldson, Thomas Davis, of St. Paul, Minn.; and Frederick G. James, of Minneapolis, Minn.

H. Ward Leonard & Co. New York (Incorporated in New Jersey), capital stock, $200,000; to carry on and supervise electrical, steam, water and other engineering and construction work; promoters, H. W. Leonard, A. St. C. Vance and E. H. Harrison, of N. Y. City.

The Homewood, South Harvey & Harvey Electric Dummy R. R. Co., Chicago, Ill.; capital stock, $50,000; to construct and operate an electrical dummy railroad from Homewood through South Harvey to and within the village of Harvey, Cook Co., Ill.; promoters, Wm. C. McClinton, Isaac A. Hartmann and Fred A. Bangs.

Edison General Electric Co., Boise City, Idaho; capital stock, $12,000,000; to supply electric power and light; promoters, J. S. Decker, W. A. Williams, E. Edes, W. S. Perry, O. Lowengard, Henry Lord, C. A. Spoffard, S. Kidder, H. M. Curtis, C. E. Eckerson—all of New York City, N. Y.; and J. B. Williams, Stamford, Conn.

LIGHT.

The city of Milan, Mo., will vote on the proposition "Shall the city issue bonds for $6,000 to purchase an electric light plant?"

At the annual meeting of the El Paso Electric Light company a new board of directors was elected, consisting of W. S. Jackson, C. H. White, Dr. P. F. D. Adams, John Curr and C. M. Williams.

M. Witz, in a recent communication to the Academie des Sciences, gives the following as the photogenic efficiencies of various lights, taking the arc light as a standard: Arc lamp, 100; glow lamp, 20; Regenerative gas burner, 2.1; ordinary gas burner, 0.7; stearine candle, 0.56.

In the last number of ELECTRICITY it was mentioned that the city council of Kansas City, Kan., had offered $340,000 for the local electric light plant. Some of the tax-payers proposed taking summary measures with the aldermen as it was asserted that the plant was not worth over $80,000. The manager of the company has now written a letter stating that the concern will not accept $340,000 but must have $375,000.

A Minneapolis paper speaking of the contract recently secured by F. E. Degenhardt, of Chicago, for the Standard Underground Cable Company, says the lucky bidder was the Standard Underground Cable Company, of Pittsburgh, the cost of the work, to be completed this year, approximating $92,000, while the grand total of the cost of the plant with extensions completed will be in the neighborhood of $120,000. The district to be covered embraces the territory from Plymouth avenue north to Cedar avenue south, and from 5th street on the east side to 9th street on the west side. Some idea of the magnitude of the work may be gathered from the fact that 82¼ miles of cable with all the accessories are necessary to put in the plant. The contract specifies that the system within the underground limits shall be all in and in working order by December 1, of this year, the Standard Underground Company having put up a $50,000 bond for the fulfillment of the contract.

POWER.

The extension of the Selby avenue cable road at St. Paul is soon to be converted into an electric line.

An injunction has been issued restraining the St. Paul Railway Company from constructing an electric railway line on Marshall avenue in St. Paul.

The city council of Vincennes, Ind., has been asked to grant a franchise to the Vincennes Electric Railway Co. The proposed lines will cover the city thoroughly. Thomson-Houston apparatus will be used.

It is said that a company has been formed in Chicago to build an electric road on Twenty-sixth street from Western avenue west to Riverside. Blue Island avenue is to be cabled to Western avenue, and the proposed electric road will have a city connection at this point.

It is reported that the Committee of Municipal Council, of Paris, have decided in favor of the construction of a subterranean tubular tramway from the Bois de Boulogne to the Bois de Vincennes, passing under the Boulevard Diderot, the Rue Rivoli, Place de la Concorde and the Avenues des Champs Elysees. Of course it will be operated by electricity.

The Flint Creek Electric Power Company, which has been formed at Helena, Mont., proposes to establish a generating plant at Flint Creek Falls, and transmit the power electrically to Phillipsburg, Granite, Rumsey, Black Pine, Georgetown, Pyrenees, Cable, Anaconda, and other adjacent points, where the power is required in mines. Those interested in the company are Thomas T. Barker, Jos. H. Harper, of Butte, and Alden J. Bennett, of Virginia City.

There are no street cars run by the trolley, storage or other electric system; no cable cars, no horse cars; not a track laid for a surface road in the city proper of London. Many Americans leave the city without ever seeing a street car of any kind, and yet in the metropolis 1,000 street cars run daily over 120 miles of track, but they are not permitted in crowded thoroughfares: they are confined to the outlying districts. The street cars are "double deckers," and, like the 'busses, they carry more outside than inside passengers, but the number of pa sengers is limited. When the car has reached its limit it will take up no more passengers. Every passenger has the right to a seat.

COMMERCIAL PARAGRAPHS.

H. B. Horford & Son, Chicago, manufacturers and dealers in patented novelties, are soon to place on the market several new electrical appliances.

The Pelton Water Wheel Company, of San Fransisco, have opened an office at 235 Central building, New York, for the transaction of eastern business.

E. Baggot & Co., dealers in gas and electric fixtures, are installing a 400-light incandescent plant to light the entire building on Adams street, Chicago, which they occupy.

The Manufacturers Advertising Bureau, of 111 Liberty street, New York, has issued a circular stating it can place advertising where it will do the most good at the time of the electric light convention at Montreal.

Manager Terry and his employes are highly pleased with the new quarters of the Electrical Supply Company on Michigan avenue, Chicago. The size of the building and rooms are such that all departments have plenty of light and air.

A. M. Morse, who has for a number of years been a member of the firm of English, Morse & Co., of Kansas City, Mo., has recently sold his interest and the successors to the old firm will be the English Supply and Engine Company.

The Western Electric Company, of Chicago, reports an increasing demand both in this country and Europe for the Patterson cable. It is generally supposed that Europeans were far ahead of this country in cable manufacture, yet the large foreign orders received by this company would lead one to think otherwise.

A. H. Massey, general manager of the western office of the Buckeye Electric Company, whose factory is at Cleveland reports a good business in the Buckeye lamp made by that company. The growth of this business is attested by the recent enlargement of their factory. A special feature of the Buckeye lamp is the coiled filament which, it is claimed, adds to the life of the lamp.

Wm. H. Weston & Co., of Philadelphia, are making every preparation to do an extensive fall business with their "Quick Brake" switch, the patent for which was granted August 4, 1891. Their representative, Mr. Plowman, visited New York last week and booked some very encouraging orders from Alexander, Barney & Chapin, Electric Construction & Supply Company, and others. They have also just patented a snap switch which has many good points and some features entirely new.

Messrs. Ferguson and Shaw, who are the New England representatives of the Rae system of street car propulsion, have secured a number of fine contracts.

Warren S. Hill, 133 Oliver st., Boston, last week shipped a large consignment of switches to British Columbia. The popularity attained by these and other of Mr. Hill's specialties attest their excellence.

The Elektron Manufacturing Co., Brooklyn, N. Y., will move to Springfield, Mass., in the fall, and will there continue to manufacture Perret Motors which are being installed in so many parts of the country. The company will employ a large number of hands.

J. F. Whitney, recently identified with the Stellar Lamp Co., has taken the agency for the Germania Electric Co. and has opened an office at 189 Asylum Street, Hartford, Conn., where he carries a full line of Shafer improved incandescent lamps, shield holders, transformers, sockets and other devices.

The pay roll of the Thomson-Houston Electric Co. last week numbered 2739 names. Last year for same week the number was 2291. This company gives employment to about 500 hands more, in various shops outside its own in Lynn, and the number is increasing steadily. During the month of July the orders received by the company aggregated over $1,200,000.

The Maine Improvement Company, of Brunswick, Me., undertakes the supervision of electrical installations of every description, inclusive of the provisions of plans, specifications, tests and reports, complete in every detail. This branch of the work is under the supervision of Thomas J. Fay, general manager of the New York office of the company, Electrical Exchange building, Liberty and Washington streets.

Messrs. Frank Ridlon & Co., 196 Summer street, Boston, continue to handle both new and second hand electrical apparatus. Users of electrical devices are continually enlarging their operations and putting in apparatus of increased power. This, of course, means displacing many good machines, almost equal to new, to make room for others. This smaller sized apparatus is what F. Ridlon & Co. make a specialty of.

The Crocker-Wheeler Electric Motor Company, of New York, has secured the services of Gano S. Dunn, electrical engineer, to superintend very fine work connected with the manufacture of the Crocker-Wheeler motors, and other specialties. Mr. Dunn is an expert mathematician and stands well as an electrician. The company has also engaged A. Hartman, as shop superintendent. This gentleman has had six years' experience in motor work. The fact that the company is thus increasing its force shows the careful attention it is paying to the manufacture of its electrical specialties.

The Robinson Radial car which left the track in Boston a few days ago, was written up in the local papers as though it were a failure. The fact was, the flange of the wheel had worn so thin that it somehow got turned over on the face of the tire and thus caused the car to leave the rails. There was nothing about the truck to cause the mishap whatever. The Robinson Company is increasing its output and shipping trucks to Brazil and other South American countries. As an evidence of the finely adjusted condition of these radial trucks, it may be stated that at Dover, N. H., recently, one of these cars carried 224 passengers at once, and took the grades and curves with the greatest ease possible. Some of the grades were as much as 11.75 per cent.

ELECTRICAL PATENT RECORD.

Letters Patent Issued August 11, 1891.

ELECTRIC RAILWAYS AND ACCESSORIES.

457,334. Pole Trolley and Stand for Electric Street Railways. Thomas E. Adams, Cleveland, Ohio. Application filed June 11, 1889.

Heretofore it has been customary to establish the electrical connection of vehicles with the overhead conductor or conductors by means of one or more traveling contacts in the form of rollers, which are pressed upwardly against and run along the conductor or conductors. According to the present invention a sliding grooved shoe is employed, the shoe or shoes being held in contact with the conductors by elastic or yielding pressure.

457,356. Trolley-Pole for Electric Railways. Charles A. Lieb, New York, N. Y. Application filed Mar. 28, 1891.

457,357. Electric Car Motor. Cyprien O. Mailloux, New York, N. Y. Application filed Mar. 18, 1891.

This invention consists, essentially, in making the motor frame in two parts, one of which is supported suitably upon the car-axle or the truck frame, as usual in the art, while the other part upon which the armature is supported is attachable and detachable from beneath, and may be lowered with the armature, leaving the main portion of the motor supported in normal position over the car axle or upon the truck frame in the usual manner.

457,359. Friction-Gear for Electric Car Motors. Cyprien O. Mailloux, New York, N. Y. Application filed Mar. 18, 1891.

This invention consists, essentially, in sleeving the driving motor upon a shaft or bearing parallel to the driven axle, but preferably upon the driven axle or shaft itself, and interposing an eccentric above between the motor bearings and the shaft or axle, said sleeve being combined with means whereby it may be adjusted circumferentially about the shaft or bearing and set in any particular position, thereby moving the motor frame and armature shaft bodily, so as to move a member of the gear train carried by said shaft to or from its opposite member, which is connected directly or indirectly with the axle upon which the motor is sleeved.

457,373. Trolley. S. H. Short, Cleveland, Ohio. Application filed March 26, 1890.

457,377. Trolley for Electric Railways. S. H. Short, Cleveland, Ohio. Application filed Nov. 6, 1889.

457,382. Electric Railway. Michael H. Smith, Halifax, Eng. Application filed Dec. 16, 1887.
In this invention the negative and positive conductors are arranged in different horizontal planes, preferably with one conductor directly over the other, and while it is not necessary to use more than a single positive and a single negative conductor, in some instances the inventor has found it preferable to make use of two positive and two negative conductors, the positive and negative conductors being arranged in separate horizontal planes.

457,660. Hanger for Trolley Wires. Nelson Newman, Springfield, Ill. Application filed Sep. 23, 1890.

457,736. Electric Railway. Rudolph M. Hunter, Philadelphia, Penn. Application filed June 21, 1886.
Claim one describes a conduit for an electric railway, provided on its upper portions with lateral flanges formed integral with the side walls, said flanges being provided with drainage apertures, in combination with working conductors located within and insulated from the conduit.

DYNAMOS AND MOTORS.

457,358. Brush Holder for Dynamo Electric Machines or Motors. Cyprien O. Mailloux, New York, N. Y. Application filed Mar. 18, 1891.

457,534. Electric Motor. W. S. Hill, Boston, Mass. Application filed June 23, 1890.
Claim one describes an electric motor the field magnets of which are composed of plates of sheet metal clamped between the end plates, recesses in said plates, and rods having reduced ends passing through the sheet-metal plates and end plates and secured by bolts, whereby the whole is securely clamped together.

457,754. Dynamo-Electric Machine or Motor. Edward M. Warning, Brooklyn, N. Y. Application filed March 23, 1891.
In general terms this invention consists of two field-magnet systems arranged one upon each side of the armature concentric with the armature shaft or axis of rotation, the pole pieces of each system being connected together to form consequent poles, the whole structure forming a cage inclosing and protecting the armature and commutator.

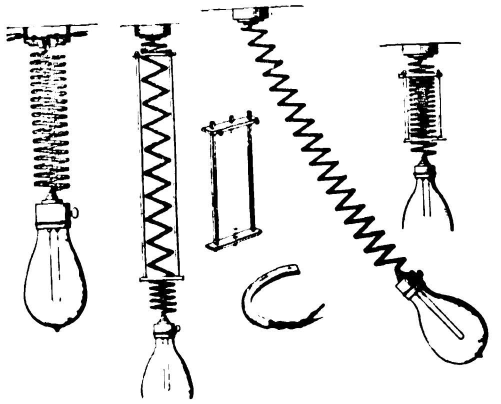
LAMPS AND ACCESSORIES.

457,573. Means for Suspending and Controlling Electric Lamps. S. Bergman, New York, N. Y. Application filed Feb. 25, 1891.

457,687. Electric Light Hanger. Frank A. Weimer, Stanbury, Mo. Application filed March 28, 1891.
This invention consists in forming the flexible conducting cord around a core of steel or other spring material and then winding the so formed cord like a spiral spring, the core having sufficient elasticity to permit it to be stretched or drawn out far enough to allow the lamp to be carried from place to place in the room or hall or even from one room to another and at the same time having sufficient strength to return and hold the lamp in its original position when the latter is brought back.

TELEPHONES.

457,477. Automatic Telephone System. Hammond V. Hayes, Cambridge, Mass., and Henry D. Sears, Lynn, Mass. Application filed Feb. 3, 1891.
The object of this invention is to furnish a system of intercommunication for such places as are unable to sustain a regular central station organization, whereby in its operation each sub-station in the system shall be enabled to place its own line in connection with any other line converging to the same point; to send call signals to the desired sub-station over the compound line thus formed without in any degree impairing the connections thus established between the two lines constituting the component members thereof, and upon the completion of the communication to restore the original normal or resting condition of both of the interested lines. An additional object of this invention is to accomplish these operations without any other sub-station apparatus than that in ordinary use and without material change in the construction of said apparatus, and, furthermore, with central station apparatus of the most simple and non-complicated character compatible with absolute certainty and accuracy of operation.



Patent No. 457,687—Electric Light Hanger.

BATTERIES.

457,430. Electric Battery. Flavien Poudroux, Paris, France. Application filed March 6, 1891.
The chief object of this invention is to solve the long-existing problem of a substitute for dynamos in electric lighting by providing a cheap, inodorous, inoffensive electric battery capable of supplying light enough for domestic uses.

457,555. Electrode for Secondary Batteries. Leonard Paget, New York, N. Y. Application filed June 5, 1890.

MISCELLANEOUS.

457,433. Automatic Electric Circuit-Switch. William L. Silvey, Lima, Ohio. Application filed April 19, 1889.
The object of this switch more especially is to open the external or electrical circuit of a street railway system whenever by any cause the conducting wires shall become crossed or short-circuited. The object is to prevent an overplus of current in the crossed circuit, thereby endangering the armatures of the generators attached to the line by reason of the overplus of current generated on the instant of closing the circuit.

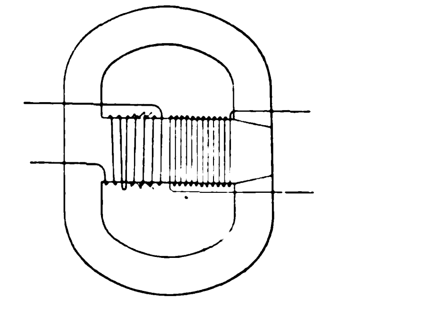
457,338. Electrical Switch. Harry H. Blades, Detroit, Mich. Application filed Nov. 3, 1890.

457,339. Electric Switch. Harry H. Blades, Detroit, Mich. Application filed Nov. 10, 1890.

457,343. Magnetic Belting. Thomas A. Edison, Llewellyn, N. J. Application filed Sept. 10, 1890.
This invention relates to magnetic belting wherein strongly magnetized iron pulleys are employed, over which runs an endless belt constructed wholly or in part of magnetic material, whereby the adhesion of the belt to the pulleys is increased.

457,362. Electric Steam Generator and Heater. Willis Mitchell, Malden, Mass. Application filed Nov. 29, 1890.
The object of this invention is to generate steam by electricity more quickly and cheaply than in the electric steam generators heretofore employed and in such volume as to answer the purpose of an ordinary engine boiler.

457,374. Safety Device for Electric Wires. John H. Sedlmeyer, Johnstown, Pa. Application filed Oct. 23, 1890.
Claim one of this invention sets forth the combination with the main conductor, or line wire, of a normally dead conductor parallel therewith, a clock mechanism, a spring-retracted switch lever connected with the line wire, and held in engagement with its contact point by the clock mechanism a detent lever forming a part of the clock mechanism, an armature lever engaging the detent to release it, and an electro-magnet for operating the armature and electrically connected with the normally dead wire.



Patent No. 457,407 Converter.

457,407. Self-Regulating Electric Converter. Thomas Spencer, Pittsburg, Pa. Application filed Dec. 17, 1890.
This invention consists in placing upon the core a few convolutions of secondary wire wound in the reverse direction from the main portion thereof, and in locating these convolutions so that the escaping lines of force do not thread them. From this construction it results that when but little current is flowing in the secondary, and consequently but little opposition is offered to the flow of the lines of force through the core, practically all these lines of force thread both the main and the reversed secondary convolutions.

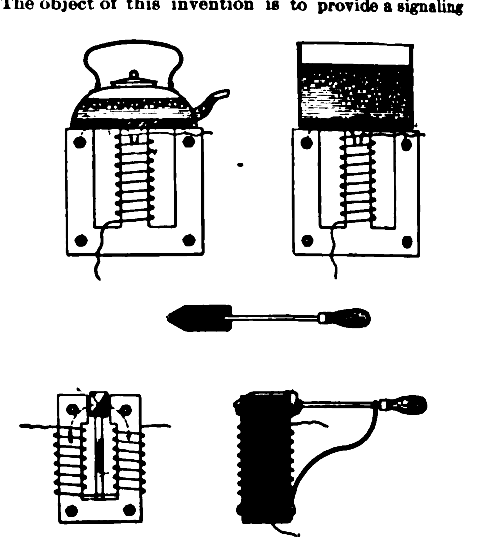
457,454. Annunciator. Walter R. McCann and Simon S. Creider, Sterling, Ill. Application filed April 23, 1891.

457,453. Electric Meter. Eugene Maylan and Wencelad Camille Reckneiwski, Paris, France. Application filed Nov. 10, 1890.
The apparatus is composed of the following arrangement of parts:
First. An electric or other motor of constant speed, imparting to a principal axis by gear-wheels a continuous and uniform rotary motion.
Second. An ampere meter or watt meter consisting of an electric balance, of which the movable part presses against a stop with a force proportional to the quantity to be measured.
Third. An "elastic cam" mounted on the principal axis and producing at each turn an increasing pressure upon the end of the balance-lever for the purpose of bringing back the balance into equilibrium without the intervention of the stop. When this weighing or automatic reading is effected, the cam escapes from the lever and regains its normal position, continuing to be actuated by the principal axis.
Fourth. A register and totalizer. By this combination it will be observed that in order to constitute a meter, in the ordinary sense, it suffices to put into relation by coupling devices, during the period of each weighing, the axis of the first wheel of the totalizer with the principal axis. In consequence the last part of the meter is—
Fifth. A clutch or coupling device which is capable of being disposed in a variety of dispositions.

457,457. Electric Oil Well Heater. Charles W. Robinson & Samuel D. Robinson, Allegheny, Pa. Application filed Feb. 18, 1891.
This invention is practiced by inserting into the well an electrically heated coil or high resistance conductor, and, when it is at the oil-bearing strata, passing through it a current of electricity, by which it is heated, so that it may communicate its heat to the well. The nature of the heating coil and of the electric current supplied thereto should at least be such that sufficient heat is generated to fuse paraffine.

457,561. Apparatus for Heating by Electricity. Rankin Kennedy, Kilmarnock, Scotland. Application filed Nov. 30, 1890.
This invention relates to that class of apparatus in which the electricity which is to be converted into heat is induced by the action of magnetism which magnetism is generated by deriving from any suitable electric generator electric currents, preferably of an alternating character. The body which is to be heated is preferably made of iron, in order that magnetism may be applied directly thereto and the heat produced within its substance. Smoothing irons, soldering irons, and other tools and utensils of similar character are heated by placing them against or between the poles of the electro-magnet, preferably provided with a laminated iron core and energized by a current, preferably alternating in its character. The magnetism is induced within the iron utensil under the influence of the alternating currents within the mass of iron of which the articles are constituted, so that the whole energy of these currents is transformed into heat within the iron.

457,565. Signal Telegraph for Cable Railways. Theodore A. B. Putnam, New York, N. Y. Application filed March 13, 1889.
The object of this invention is to provide a signaling



Patent No. 457,561—Electric Heating Apparatus.

telegraph by means of which an alarm may be given in the power house by the driver of any one of the grip cars whenever he finds that his grip has got caught by the cable so that he cannot release it. By this invention the signal can be given by the gripman without leaving his post and without a moment's delay.

457,572. Switch. S. Bergman, New York, N. Y. Application filed Jan. 26, 1891.

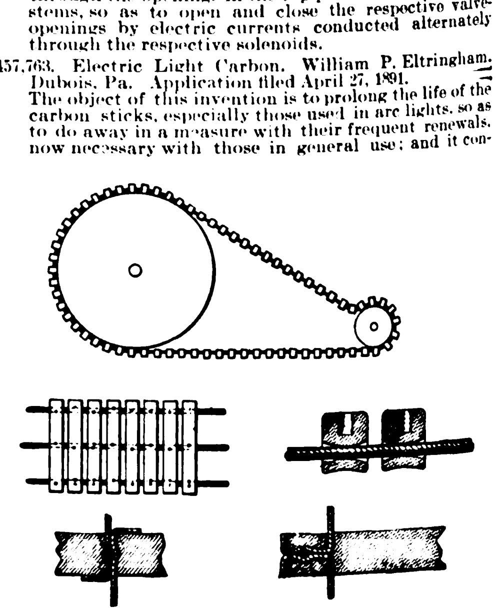
457,657. Wind Apparatus for Generating Electricity and Charging Secondary Batteries. James M. Mitchell Lawrenceville, Ga. Application filed March 23, 1891.
This invention relates to apparatus whereby wind-power may be applied to operate a dynamo-electric machine for the purpose of generating a current which may be utilized in charging a secondary or storage battery to supply lighting, motor and other circuits.

457,745. Electrically Heated Oven. Willis Mitchell, Malden, Mass. Application filed Nov. 29, 1890.
This invention has for its object to increase the efficiency of electrically-heated ovens and to protect and insulate the heating wires more effectually and easily than hitherto. For these purposes the inventor constructs the bottom, top and sides of the oven with successive layers of asbestos or other insulating material, the bearing wires being wound around the interior space of the oven in successive coils or layers and practically embedded therein.

457,761. Connection for Electric Conductors. Joseph Dillon, Larchmont, N. Y. Application filed Jan. 16, 1890.
This invention provides a case or shell for inclosing the joined ends of the conductors with parallel openings through which the ends of the cable or sheathed wires or groups of wires are thrust, and into which they are fastened in a manner both rigid to resist mechanical flexure and impermeable to air and moisture. The case or shell is constructed with a cap or cover, which can be applied, and removed independently of the connection of the cable ends in said openings. The ends of the conductors in the case are bared of insulation, and being arranged parallel with each other, are electrically connected by applying to them a bridge-piece of copper or other conducting metal, the ends of which clasp the bared wires, and which are preferably soldered to them.

457,762. Electric Air Pump. Allen A. Dittmar and Hugo Falkenhausen, New York, N. Y. Application filed Jan. 23, 1891.
Claim one describes an electric air pump, suction and discharge compartments communicating with the pump-cylinders by valve-openings, in combination with solenoids placed over openings in the top plates of the compartments and having movable cores which pass through the openings in the top plates and act as valve stems, so as to open and close the respective valve-openings by electric currents conducted alternately through the respective solenoids.

457,763. Electric Light Carbon. William P. Eltringham, Dubois, Pa. Application filed April 27, 1891.
The object of this invention is to prolong the life of the carbon sticks, especially those used in arc lights, so as to do away in a measure with their frequent renewals, now necessary with those in general use; and it consists in heating or tempering the carbons by the use of borax, or any equivalent of borax, either during the process of manufacture of said carbons or afterwards.



Patent No. 457,343—Magnetic Belting.

ELECTRICITY.

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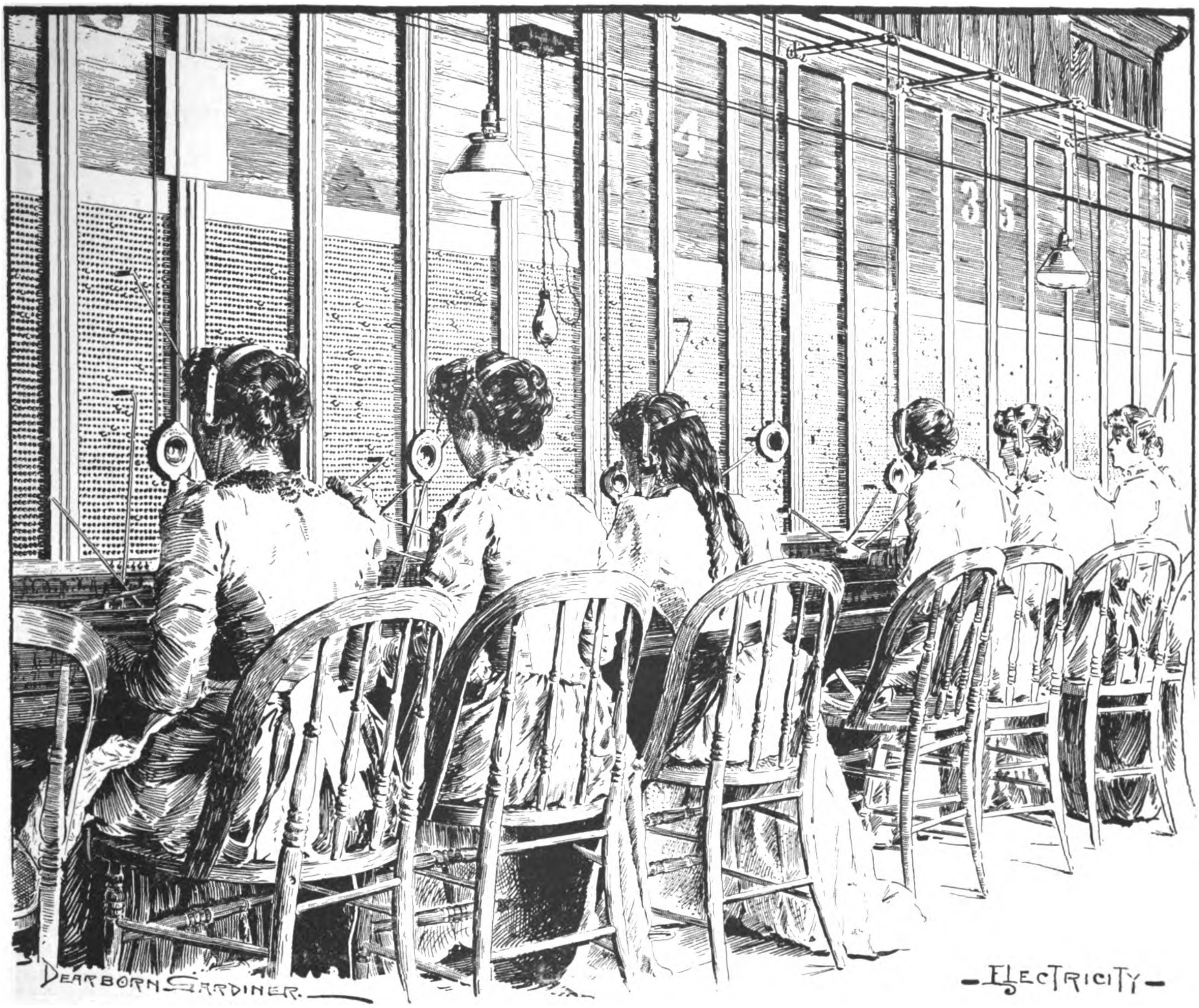


TRAVELING ELECTRIC LIGHT FOR INSPECTING TELEPHONE SWITCHBOARDS.

(*See page 76.*)

TRAVELING INCANDESCENT LAMP FOR INSPECTING TELEPHONE SWITCH-BOARDS.

(*See Frontispiece.*)

No collection of electrical apparatus is so complicated or contains such a multiplicity of small parts as the operating equipment of a telephone exchange. The immense switchboards in use at large exchanges contain a fabulous number of small devices, each having several contacts and connections. All of these contacts must be kept clean and all the connections must be readily accessible for inspection and for the alterations and renewals which are occasionally required. Some idea of the work that this entails and the care with which the work must be done may be obtained when it is mentioned that in one switchboard in a large exchange there are about 260,000 spring jacks. A defect even amounting to nothing more than a dirty contact in one of these parts may temporarily throw a subscriber's line out of service, thereby causing more or less inconvenience to several persons and loss of revenue to the company.

The most unceasing vigilance is necessary to remedy these defects as quickly as they occur, and in such work as this the maxim that an ounce of prevention is worth a pound of cure is especially applicable. The chief difficulty in the way of a thorough inspection of the myriads of nooks and crannies in a telephone switchboard is that of securing a powerful light on the parts to be inspected. Most modern telephone buildings are provided with electric light service, but even so, the exchange manager or trouble hunter is hampered by having to move his lamps and cord from place to place, his range of observation being limited by the length of his lamp cord. When he has reached the end of his tether the cord has to be attached to a fresh socket at some other point; this entails loss of time and the long trailing cord is often an inconvenient obstruction.

The manager of a large telephone exchange has recently found a way out of the difficulty in an ingenious manner. His plan is to string two stout bare copper wires around the room above the switchboard. These wires are connected to the electric lighting circuit and are so suspended that they form a track for a miniature four-wheeled car. The wheels of the car are of copper and those on one side are insulated from those on the other. The car thus forms a traveling connection with the lighting circuit. An incandescent lamp cord is attached to the car and connected with the wheels through the framework. In this way, as the frontispiece shows, light can readily be obtained at any part of the switchboard with a minimum of trouble. The lamp simply hangs down from the car, the length of the cord being adjustable so that the light can be directed to any part of the switchboard where it is required. There is no cord trailing on the floor to become entangled with tools or wires, and no time is lost in changing cords and sockets when it is necessary to move the light to another part of the board. The car is run along the wires with ease and the lamp taken wherever it is needed, either at the front or at the back of the switchboard.

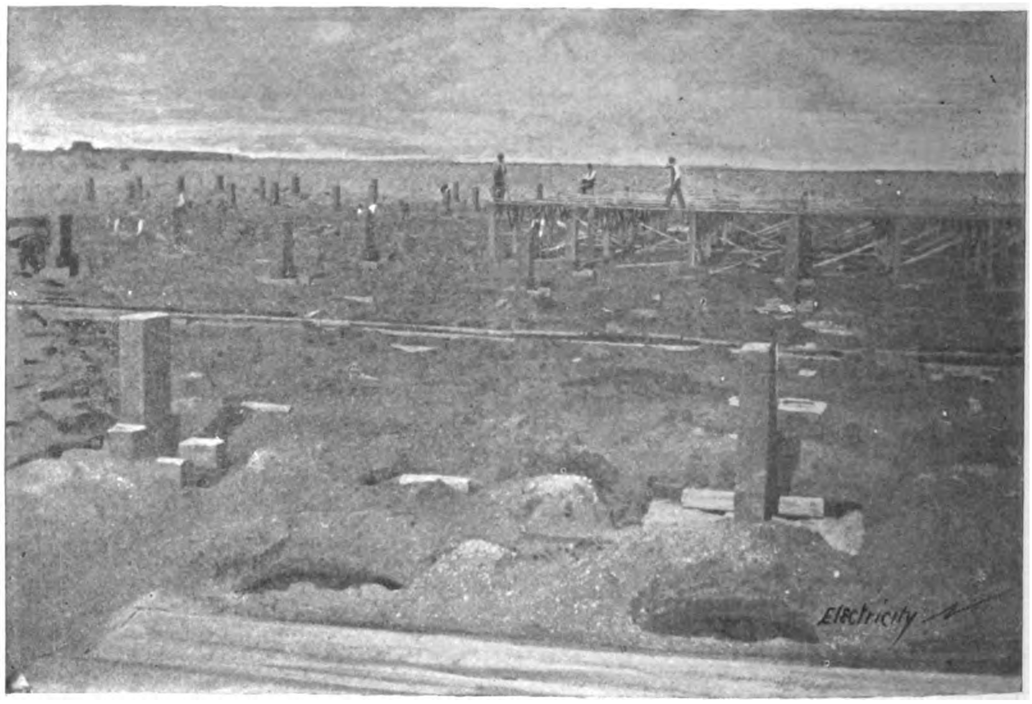
AN ELECTRIC CABLE RAILWAY.

An interesting illustration of the transmutation of energy, involving no less than four inversions, comes from Switzerland.

A new cable railway is being constructed on the Stauserhorn to compete with the neighboring lines up the Righi and the Pilatus. It will be nearly two miles long and divided into three sections, each of which will be independent of the others. The cable for each section will be operated by an electric motor of 50 horse power and the current for the motors will be generated by dynamos driven by turbines, located at Buochs, three miles away.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

In the issue of August 19th, was presented a cut illustrating the condition of the electrical building at the World's Fair grounds. This was taken about August 1st, and represented nothing but a pile of lumber. The accompanying illustration is another view which was reproduced from a photograph taken on the afternoon of August 25th. The hour was 3 p. m. when presumably the full force was at work. If examined very closely twelve men may be actually counted. It is not asserted that they are all working, but there are twelve men on the site of the new building. Progress has undoubtedly been made since the date of the first illustration and probably as much as could be reasonably expected from the labors of twelve men for twenty-five days. This picture gives the lie to the reports circulated in the daily press of the large force of men continually employed on the buildings at Jackson Park. It is to be hoped that Mr. Burnham will be forced by public opinion if not by the Exposition Commissioners to put more energy into his management. The electrical people have never been much pleased with him since he told them they did not know what they wanted, and his popularity is not likely to increase when the public sees what little he is accomplishing, as shown by the illustration.



CONSTRUCTING THE ELECTRICITY BUILDING AT THE WORLD'S FAIR GROUNDS.

Prof. J. P. Barrett, Chief of the Department of Electricity, of the World's Columbian Exposition, has forwarded a report to Col. Clowry, chairman of the committee on electricity, giving an outline of the work accomplished to date. After his appointment, says the professor, his first work was to ascertain the wishes of the representatives of the electrical interests, to lay out a complete scheme for the department, and to find out what they proposed to do to forward the success of the department. He has met with a gratifying response and the electrical people are enthusiastic. Most corporations have made appropriations for the installation and maintenance of exhibits, the sums varying from $5,000 to $50,000. They have already commenced work on the exhibits, and the department will, says the professor, meet the requirements of its most enthusiastic friends. Actual demands for 55,377 square feet of floor and wall space have been received, and preliminary or tentative applications for an additional 62,300 square feet have been sent in. Companies sending the latter before reaching definite decisions want information which the department is as yet unable to give. In addition, notifications of intention to exhibit have been sent by companies desiring 75,000 square feet. The total space thus asked for is 192,677 square feet. In regard to foreign exhibitors a special effort must be made to secure their participation, as expositions are overdone in Europe, and Europeans are inclined to consider the tariff as a barrier which will preclude the possibility of advantage from the exhibition of their apparatus in the United States. The professor thinks that a spirit of rivalry must be developed among these foreign manufacturers and he will sometime in in the future recommend that a representative be sent to them to excite their interest. From this time on the campaign will be an active one, and the work of the department will be prosecuted along all lines.

Prof. Barrett returned from his trip east last Sunday. In an interview he reported eastern electrical manufacturers as very enthusiastic over the World's Fair in general and the electrical department in particular. They all without exception placed themselves at his disposal.

Some of the directors are very anxious that Prof. Barrett should go to Europe, and particularly to Germany, to make a study of the electrical exhibit at Frankfort. A resolution was passed at one of the committee meetings this week requesting Director General Davis to send Prof. Barrett abroad. In answer to the question whether he would accept the invitation of the committee to travel two months in Europe at the expense of the Fair, Prof. Barrett said: "The department should have a representative there, but whether I shall go or not will be settled later."

The question of an intramural railroad will be taken up and decided by Chief Burnham the early part of this month. No system has yet been adopted for moving passengers in Jackson Park, but an electrical road seems to be probable. However, propositions will be entertained from all kinds of roads.

The report of the Chief of the Electrical Department to Director General Davis will be out early next week. This report will be included with the reports of the chiefs of other departments in the general report of Director Davis to President Harrison and the members of congress.

The Wheeling Electric Light Commission which recently made a tour of the country in search of information on electric lighting, was much more industrious than most municipal bodies enjoying a junket. The commissioners were absent sixteen nights, and eleven were passed on sleeping cars.

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Communications relating to subjects within the province of this journal are cordially invited. News notes, descriptions of new devices with drawings or photographs, are at all times desired.

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WE print in this issue an abstract of a paper by Prof. J. A. Ewing, F.R.S., embodying the results of his investigations as to the influence of joints on the magnetic circuit. This first installment treats of joints where the contact surfaces are true planes. In our next the influence of joints between undressed surfaces will be taken up. These investigations are of the utmost importance in dynamo and motor construction, and will doubtless be followed with interest and profit by those engaged in lines of work to which they apply.

* * *

IN THIS issue appears an article on the rapid transit problem in Montreal. The members of the National Electric Light Association will doubtless be called upon to give expert testimony in regard to the question during their visit in the city during the convention next week. The facilities for travel in Montreal are lamentably inadequate. The cars are few and far between, and their slowness is intolerable. Every resident recognizes how miserable is the service, yet it is the general belief that the substitution of electric motors for the slow-going mules is impracticable on account of the snow fall during the winter. While this belief obtains in Montreal an entirely different view is entertained in Ottawa, a hundred miles away. A local company has just started an electric railway system which promises to do wonders for the sleepy capital of the Dominion. The climatic conditions in Ottawa are practically the same as those of Montreal, yet the enterprising owners of the road in the former city profess entire confidence in their ability to operate the road throughout the winter in spite of snow and ice. They have made calculations based on the theory that they will have to clear away the snow entirely from streets on which their lines are located. At the highest estimate for labor they say they can, with the electric railway system, continue operation, and that their books will not show a balance on the wrong side. They say they do not expect to make money during one or two months but they will keep the cars running. If this experiment in Ottawa is successful a great many cities in Canada which are unprovided with street car facilities will make contracts for electric equipments within the next year.

* * *

SIR WILLIAM THOMSON'S law of the economical size of conductors has probably been the cause of more controversy in its application than any other in electrical science. This is so, not because of any inaccuracy of the law itself in its legitimate application, but because of the numerous attempts to found upon it one of wider and more general application, involving other factors that are in no sense functions of those they are intended to expand.

We print as a supplement this week a very valuable contribution from Mr. H. Ward Leonard, in which he derives formulæ, starting from an entirely different datum point, applicable to all the problems of minimum first cost and maximum economy, which, by the way, he points out are not synonymous, and shows where others have fallen into error in the discussion of the same questions. In this way he makes the issue between himself and them definite, so that should there be room for discussion it will certainly be forthcoming.

The accompanying charts worked out by the formulæ enunciated, by the aid of which the various problems can be solved without recourse to mathematics, will be appreciated as well by the technical as the untechnical reader.

We commend this article to all of our readers as the most intelligent attempt thus far made to solve this perplexing question.

* * *

THE *Electrician* (London) takes a most decided stand against the exhibition of British machinery, and manufactures at the Columbian Exposition. In a lengthy editorial on the subject it says that while Great Britain's commerce with the United States is greater than that with any other country it forms but 14 per cent. of its commerce with the world, and that the United States evinces in the McKinley Bill a fixed determination to make this less. It says that "it is difficult to see what English commerce as a whole, has to gain by a lavish display at Chicago. It is to be doubted whether the *quin centenary* (sic) of Columbus' arrival in the West Indies is a sufficiently powerful lever to move Englishmen with their inborn conservatism to dispatch goods several thousands of miles across land and water to encounter on their arrival the chilly blast of the McKinley tariff. The official support and the efforts of the Royal Commission and the Exhibition Commissioners notwithstanding, we venture to predict that English exhibitors will not be present in Chicago in full force" and adds "However convincing the arguments for holding aloof from the 1893 Exposition may be when applied to the industries of England as a whole, they apply with *with redoubled force to the electrical industry.*"

We are surprised and grieved that our esteemed contemporary should look upon our little undertaking with such narrow views. The argument that the McKinley tariff will tend to decrease their commerce with this country would appear to be the very reason why extraordinary efforts should be put forth to counteract this tendency and we feel sure that in no way can this be so effectually accomplished by our British cousins as by coming to our doors and showing us their wares in a way and on a scale never before attempted. The English, while they have a reputation for conservatism, of which they seem to be proud, also have a reputation for good solid sense of which they have a right to be proud and which, we think, will manifest itself in a liberal representation at our show or fair as the *Electrician* is pleased to term it. We think their cool calculating good sense will show them that however much we may want them to come here, their loss will be greater than ours should they hold themselves aloof.

As to electrical matters the *Electrician* implies that they will have nothing to learn from us. This may be true, but we have been of the opinion that we had something to show in that line. We have not considered it presumptuous to flatter ourselves that a country that has given to the world the telegraph, the electric light, the telephone and electric street railroad and in which these inventions have reached a development an hundred fold greater than they have in any other country on the globe—we have not considered it presumptuous to flatter ourselves that we have something to show. Yankee ingenuity is proverbial, and while our slower relations across the sea may turn out more finished products in some cases, we believe we can show them some Yankee tricks that will enable them to turn them out faster without sacrifice of efficiency or utility. For the benefit of the *Electrician* we will say that our coming exposition is in celebration of the *four hundredth* anniversary of the discovery of America—not the *five* hundredth; that the Indians are now all on their reservations and the Government promises to keep them out of Chicago during the Exposition and that the buffalo has entirely disappeared from the streets of the city.

* * *

WHILE the directors of the World's Columbian Exposition are in the mood for enlarging buildings, would it not be a good idea if the electrical fraternity in general, and the Electrical Department of the exposition in particular, again pressed their claims for larger space for exhibition purposes in the fair grounds? The directory has resolved to enlarge the manufactures building by an addition of fully eight acres. This extension was secured solely by the energetic work of a single director. If similar pressure was brought to bear by the electrical fraternity, would not results so earnestly desired be accomplished? The enlargement of the Electricity Building would not of necessity retard construction or involve changes in the structural plan. It would necessitate simply an expansion along lines already agreed upon. No new arguments are necessary to prove the advisability of enlargement, although facts which are coming to light prove beyond doubt that the space allotted to the electrical display is too limited for an adequate showing. If the National Electric Light Association, as a representative body, at the Montreal convention entered its protest against the present allotment of space, it perhaps might induce the directory to reconsider its decision. When it is remembered that many changes have recently been made, and that the chief of the electrical department is now placed in a better position in reference to the chief of construction, it would appear that there still might be a chance to secure a modification of the plans.

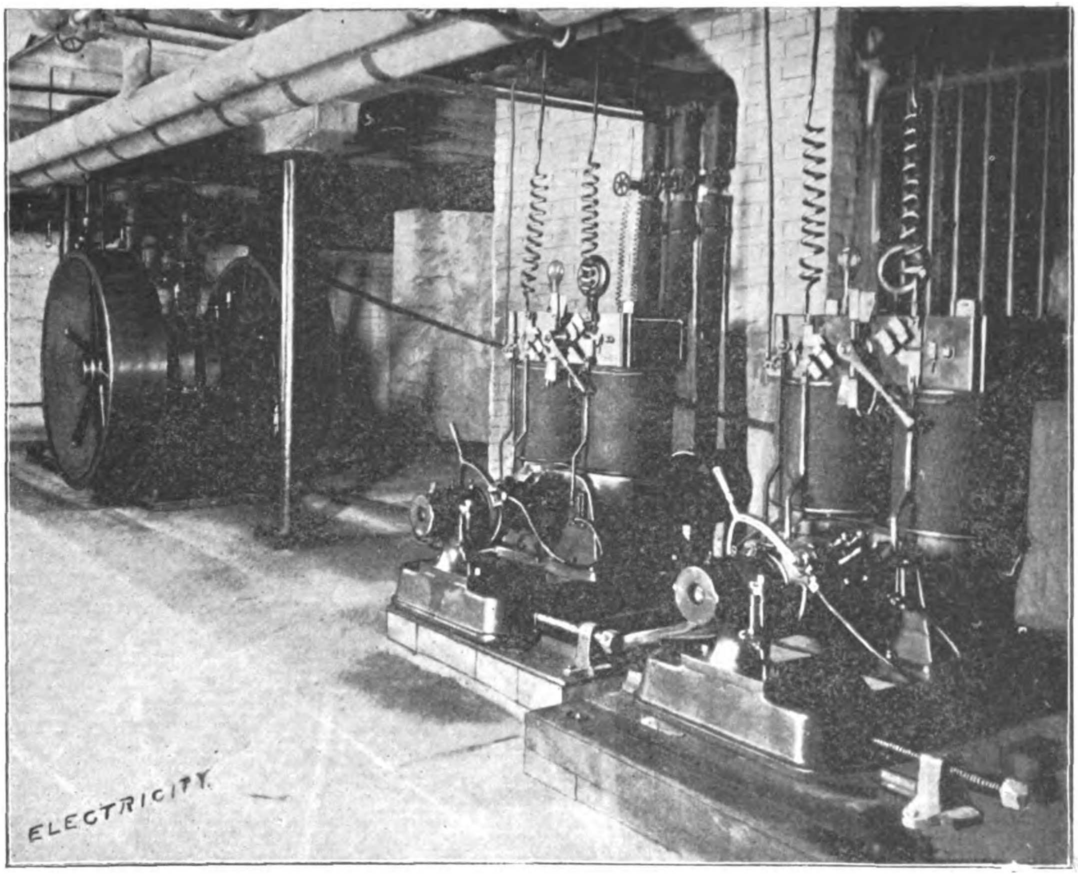
MONTREAL, AND THE NATIONAL ELECTRIC LIGHT CONVENTION.

In this and the next issue of ELECTRICITY descriptions and illustrations of the more important electric light plants in Montreal will be presented. The city is well provided with electric lights, although the demand is not what it should be. There are two central stations both of which are operated by the Royal Electric Company. Two other plants furnish light to customers, but they are perhaps not sufficiently large to be called central stations.

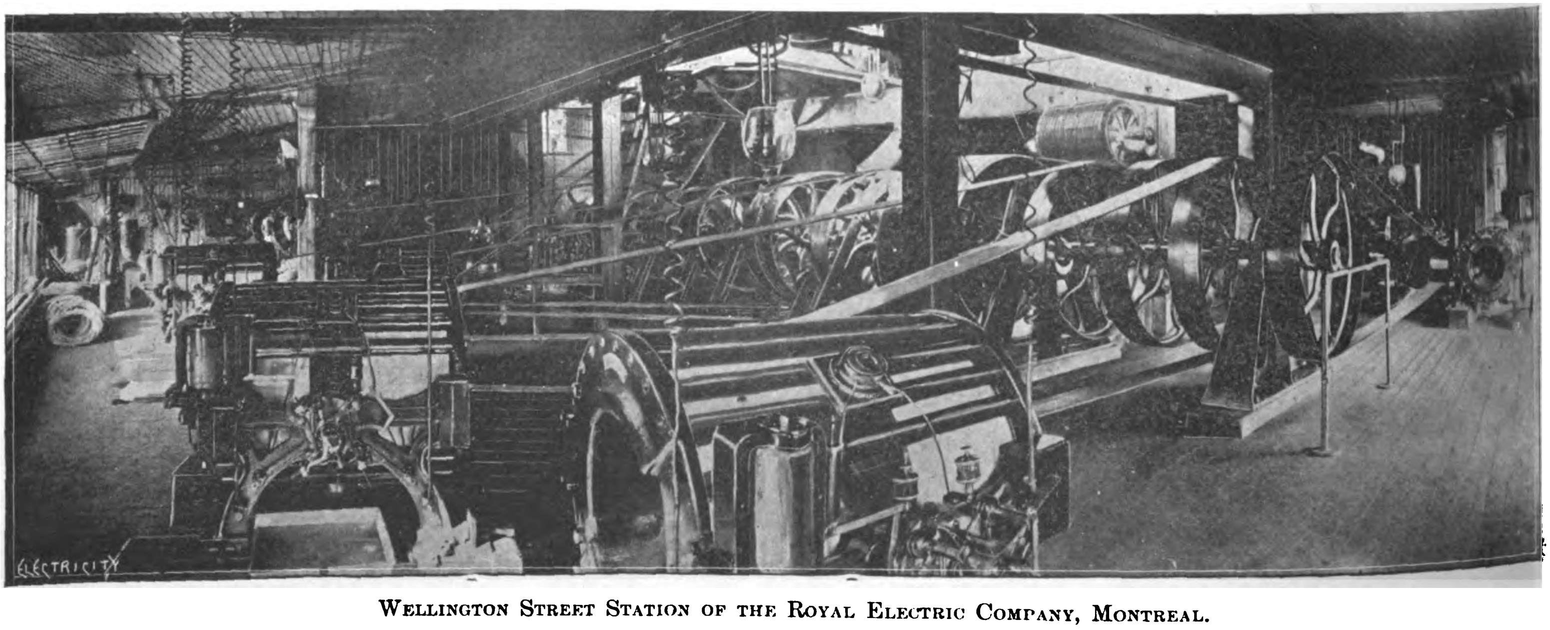
In the last number of ELECTRICITY an illustrated description of the arc station of the Royal Electric Company was published. In the company's building on Wellington street two additional electric light plants are located, one at the east and the other at the west end of the structure. A part of the west end plant is shown in the accompanying cut. Those who visit the station will readily appreciate the fact that the plant is not one which can be adequately represented in an illustration. In these two plants is generated the current for all commercial lights, arc and incandescent. Only alternating current incandescent dynamos are employed, as in the immediate vicinity of the plant there is no demand for incandescent lamps. All the electrical apparatus was manufactured by the Royal Electric Company under the Thomson-Houston patents. There are used in the plant 20 arc machines ranging in capacity from 35 to 50 lamps; one 1500 light alternator, and one 1200 light alternator, and two 75 horse-power generators for power circuits. Power is furnished by two pairs of Brown automatic engines, each pair of a capacity of 450 horse power; one engine of the same type of 300 horse power, and two 50 horse power high speed engines. The Brown engines were built by the Paulson Iron Works of Toronto, and the high speed engines by Perkins of Toronto. Water for condensing is taken through a nine-inch main from the Lachine canal, about 900 feet distant. Two Blake condensers are used. There are nine boilers in the boiler room; five are horizontal tubular return boilers of 100 horse power each, two of the same type are of 125 horse power each, and two are Babcock & Wilcox boilers of 250 horse power each. The station has a smoke stack 125 feet high, and six feet in diameter. In both the East End and Wellington street stations the company uses for fuel Pennsylvania hard coal and soft coal screenings. The mixture is found to give excellent results. In charge of the stations are Fred Thomson, chief electrician, D. Thomson, superintendent of lighting and power department, and George Hunt, chief engineer.

The Royal Electric Company, which controls these extensive plants, was organized in 1883 under the name of the Thomson-Houston Electric Company. Subsequently the name was changed to the American Electric & Illuminating Company, and again in 1884 to its present title. Besides its electric light plants the company owns the largest electrical factory in Canada, which is located in its building on Wellington Street. In the factory in which all kinds of Thomson-Houston apparatus are constructed, 250 hands are employed. Charles W. Hagar is general manager of the company. The other officers are J. P. Thibaudeau, president; W. J. Withall, vice president, and H. H. Henshaw, treasurer.

The Imperial building located on St. James St., opposite Place d' Armes Square, is lighted by the Edison system. As the accompanying cut shows, there are in the plant two machines each of which is of 270 lights capacity. Power is supplied by a Leonard-Ball engine of 50 horse power. Steam is generated in two Field-Sterling boilers, of 60 and 40 horse power. George Wilson is the engineer in charge of the plant.



EDISON ELECTRIC LIGHT PLANT IN THE IMPERIAL BUILDING, MONTREAL.



WELLINGTON STREET STATION OF THE ROYAL ELECTRIC COMPANY, MONTREAL.

NEED OF RAPID TRANSIT IN MONTREAL.

Montreal does not possess rapid transit. To those accustomed to electric cars the street railway system seems extremely inadequate, and behind the times. It has been stated repeatedly that if the cars could be operated by electricity the number of passengers would be trebled. At present a vigorous pedestrian finds that he can outstrip the cars, and is not inclined to give the company much of his patronage. When in a hurry he hires a cab; otherwise he walks.

There has been quite a little talk concerning the equipment of the several lines with electric motors. The city is growing rapidly, and better facilities for reaching the outlying districts are urgently demanded. Nothing has been done yet in

regard to using an electric system for the reason that it is assumed that it would be impossible to operate an electric road under the existing conditions.

Montreal streets abound in heavy grades but while these could unquestionably be surmounted another obstacle has stood in the way. For several months in the year Montreal streets are covered with snow and ice to the depth of two or three feet. The temperature never rises high enough to cause this icy covering to disappear. During this period the ordinary street cars are abandoned and sleighs are used instead. Last winter the sleighs were operated from the latter part of November until about April 1st, and during that time the street pavement was not visible. It would not be impossible for snow plows to keep the tracks clear but if this were done and the snow were thrown on each side of the rails the streets it is said would be impassable for teams, for in most cases the thoughfares are narrow. A trough four feet deep cut in the center of a street would certainly not prove desirable if sleighs drawn by lively horses were used to any considerable extent.

It is said that the only practicable way would be to remove entirely the enormous mass of snow from such streets as were occupied by tracks. The expense attending such an undertaking would, it is claimed in Montreal, make it prohibitive. While it may be possible to overcome these obstacles certainly the residents of Montreal believe that they are insurmountable and that a surface electric railway could not be successfully operated.

In view of these facts it has been suggested that an elevated railway, to be operated either by electricity or by steam, might be constructed. The matter has been talked of in a general sort of a way but it is thought that the immense sums which it would be necessary to pay as damages to persons occupying property on the route would necessitate such an enormous investment that the road would never prove profitable. Of one thing the residents are certain: They require rapid transit but they are doubtful of all plans which have thus far been suggested as solutions of the problem.

Several gentlemen in Montreal are now talking of forming an electric railway to operate during the summer only. The proposed route is mainly over side streets running north and south. It is proposed to discontinue the operation of the road entirely during the winter months.

It is interesting to note that the electric railway company, of Ottawa, Ont., looks at matters from an entirely different standpoint from the Montreal gentlemen quoted in preceding paragraphs. The cities are only a little over 100 miles apart and the winter climate is practically identical in the two places. The Ottawa company says it can operate its cars without difficulty. It proposes when necessary to clear the streets on which it operates from snow. This course, it claims, will not entail such an expense that the operation of the road will be actually unprofitable during the winter months. In regard to its ability to keep its cars running, the company refers to the success which has attended the efforts of the electric railway in Bangor, Me., which has to contend with difficulties about the same as those which will confront the Ottawa company.

A number of companies in Canada will watch the experience of the Ottawa company during the coming winter with no little interest. If it is successful in its fight with snow and ice, a number of cities will be inclined to adopt an electric system.

CONVENTION NOTES.

For the accommodation of delegates to the convention a special train will leave the Grand Central station, 42d street, New York, at 10 a. m., Sunday, Sept. 6th, arriving in Montreal at 9:35 p. m. The fare round trip, to Montreal is $12, round trip certificate plan, $13.33; one way, $10; parlor car extra each way, $2. Those who desire to secure tickets in advance may purchase them at the New York Electric club next Saturday afternoon, or at the office of the New York Central, 413 Broadway.

A Montreal paper says: "As far as the exhibition itself is concerned, everything goes to show that it will be wonderfully successful."

At a recent meeting of the Province of Quebec Press Association, it was voted that the press should do all in its power to advance the success of the convention.

Members and others who attend the Montreal Convention will go by way of the Chicago & Grand Trunk Railway. The train leaving Chicago daily at 3 p. m. arrives in Montreal about 8 o'clock the next evening. Leaving Chicago next Sunday afternoon visitors will reach Montreal in time to be present at the formal opening of the exhibition on Monday evening.

The Traffic Associations have named a rate of one fare and a third from eastern points via all rail routes to Montreal. In taking advantage of this rate it is necessary to go and return by the same routes. The summer tourist's rate to Montreal and return from Chicago is so low that there is not much advantage in the concession granted in the east. Tourists' tickets carry all sorts of privileges that is, one may select his route to his liking and go and return by different routes.

"Many people seem to think" said an eastern visitor the other day, "that when the last day of August passes into history the season for summer travel is at an end. But the most delightful month in all the year for a vacation trip is September. Our electrical friends who have a chance to attend the convention next week and at the same time enjoy the rare delights of a little season of rest in the region of the St. Lawrence ought not to miss the opportunity."

C. Lee Abell, of the transportation committee of the National Electric Light Association, has sent out a circular of which the following is an extract:

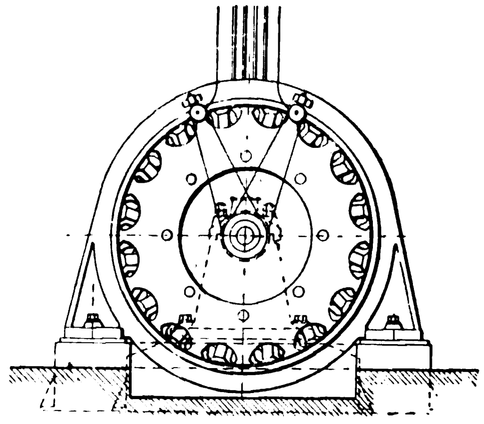
A large number of delegates evincing a desire to go to Montreal by steamer through the river St. Lawrence, and for the ride through the famous Lachine rapids, the following rates and routes are suggested for the information of members: The Grand Trunk route by rail from Buffalo to Toronto or Kingston, and thence via the R. & O. steamer to Montreal; the rates are, from Buffalo to Toronto, $3.15; from Toronto to Montreal, $6.00; from Buffalo to Kingston, $6.95; from Kingston to Montreal, $3. To entitle passengers via the steamer route to this reduced rate, it is necessary to procure a certificate with the purchase of the rail ticket to Toronto or Kingston, which is to be shown to the agent when purchasing the ticket on the steamer. By procuring a certificate from the purser of the steamer, purchasers of these tickets are entitled to buy a return ticket to Buffalo by rail at two-thirds of the regular rate, (which is $7.60,) making the round trip $16.75. Berths on the steamer are $1; state-room, $2. Sleeping cars can be taken either from Niagara Falls or Toronto through to Kingston or Montreal. A large number of delegates intend to assemble at Toronto in time to take the steamer leaving there September 5th, at 2 p. m., passing Kingston at 5 a. m., September 6th, arriving at Montreal 6:30 p. m., September 6th. For the benefit of delegates and others who may not be able to meet the steamer at Toronto, the 9:15 p. m. train via the New York Central R. R. from Buffalo, will meet the steamer at 6 a. m. Sunday September 6th, at Clayton, at the head of the river, which will give passengers the entire ride through the river and rapids. The fare from Buffalo to Montreal via Clayton is $11.50; returning the same way, $19.00. To those desiring to visit Boston and New York, tickets may be purchased via this route, viz; Clayton, Montreal, Boston, to New York, $24.50; from Syracuse, $21.65. Sleeping cars run direct from Buffalo to Clayton.

The city of Augusta, Ga., recently celebrated the substitution of electricity on its street car lines by running an old mule-power car along the track followed by one of the palatial electric motor cars, decorated with flags and bunting. Since comparisons are odorous we can imagine the feelings of the mule.

LONG DISTANCE POWER TRANSMISSION FROM LAUFFEN TO FRANKFORT.

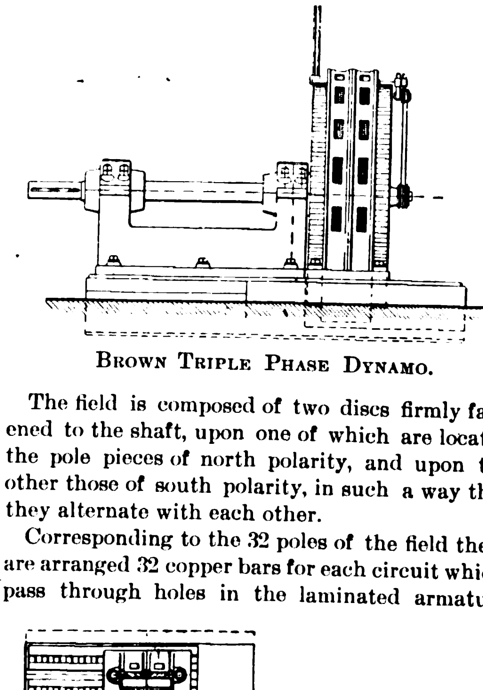
Great interest is attached to the experiment about to be tried of transmitting 100-horse power by electricity from a waterfall at Lauffen to Frankfort on the Main, a distance of a little over 100 miles. Interest is aroused not alone on account of the distance involved but also because of the system employed which is different from that heretofore used.

In the accompanying illustrations, the dynamo



BROWN TRIPLE PHASE DYNAMO.

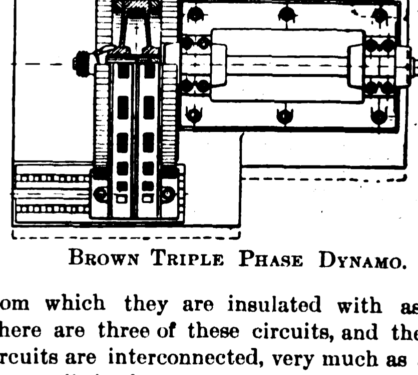
capable of generating 300-horse power at 150 revolutions, which was designed by Mr. C. E. L. Brown, of the Oerlikon works in Switzerland, is shown. The armature is arranged to give three separate alternating currents differing in phase from each other by 120 degrees. In this machine the armature is stationary while the fields revolve.



BROWN TRIPLE PHASE DYNAMO.

The field is composed of two discs firmly fastened to the shaft, upon one of which are located the pole pieces of north polarity, and upon the other those of south polarity, in such a way that they alternate with each other.

Corresponding to the 32 poles of the field there are arranged 32 copper bars for each circuit which, pass through holes in the laminated armature



BROWN TRIPLE PHASE DYNAMO.

from which they are insulated with asbestos. There are three of these circuits, and the three circuits are interconnected, very much as are the three coils in the armature of the Thomson-Houston arc machine.

A novel and effective method of exciting the fields without the use of sliding contacts is the

employment of two pairs of pulleys—one fixed on the revolving shaft connecting with the field coils and the other pair connected to the terminals of the armature. Over these run wire conducting-belts or cables, along which the current passes.

The windings of the armature for the three circuits, in this case consisting of copper bars 1.18 inches in diameter, as before stated, occupy recesses in the mass of the armature itself. They are therefore mechanically protected from abrasion and this arrangement permits of less clearance between the revolving field and the armature and consequently a better magnetic circuit. Each bar being wholly surrounded by iron is firmly held in its place and is therefore protected from all tangential strains to which it would be subjected by the usual arrangement.

The current in each of the three circuits is 1,400 amperes at 50 volts.

Of course, at this low electromotive force it would be impossible to transmit any considerable amount of energy to a distance. Step-up transformers are therefore employed which transform the current to an equivalent one of high potential and low quantity which is transmitted to the distant point by three circuits or six wires, where it passes through other transformers reducing it again to low potential and large quantity, in which form it is used to drive motors and do other work.

The use of large bars as armature windings has usually resulted in such losses, due to eddy or foucault currents, as to cause their abandonment, but by the method employed by Mr. Brown of burying these bars in the iron of the armature, it has been found that in bars having a diameter as large as 1.96 inches, the losses due to this cause were insignificant.

The generator above described can be used as a motor, the peculiar arrangements of the currents causing a revolving magnetic field, the polarity of this field making one revolution for each period of the alternating current. The employment of a rotary field is not new, as it originated with Arago, but has been developed of late years by Ferraris, Hutin and Leblanc, Tesla, Dolivo-Dobrowolsky, Haselwander, Bradley, Wenstrom, and others, most of whom used two alternating circuits whose phases differed by a quarter.

When used as a motor this machine, like all other alternating current motors, must be run synchronously with the generator, but possesses the great advantage that it can be started from a state of rest, by employing a separate exciter until it gets into synchronism with the generator when it will become self-exciting. But when the motor and generator are started together, the motor becomes self-exciting at once, as the torque of the motor rises with the speed of the generator in a perfectly satisfactory manner.

The total weight of field magnet copper in the generator is 660 pounds or only about one quarter that required on a dynamo of 300-horse power of other types.

The exciting current for the magnet field at normal speed and open circuit at a potential of 50 volts is about 100 watts or one twentieth that usually required for a 300-horse power generator, and the total exciting current including that necessary to counterbalance the armature reaction is less than one per cent. of the total output.

Speed trials show a commercial efficiency of 96 per cent.—a figure that has not been surpassed under like conditions of speed and output.

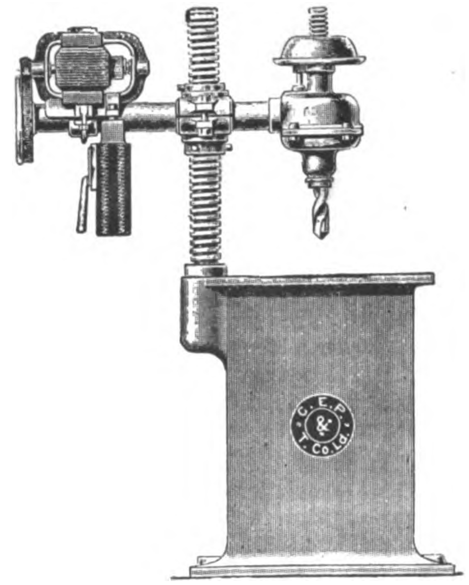
The total weight of the machine without the foundation plates is 19,800 pounds.

While this machine is, to a certain extent, an experiment, it is such only as to its size, since smaller machines built on the same lines have been constructed and have been in successful operation for some time, transmitting energy to distances of from six to fourteen miles.

The drawings from which cuts were made were sent to ELECTRICITY by the inventor of the dynamo, C. E. L. Brown.

PORTABLE ELECTRIC DRILL.

The accompanying illustration shows a novel application of a small motor to a portable drill with radial arm. The motor, which is of the Immisch type and one-half horse power, is at-



PORTABLE ELECTRIC DRILL.

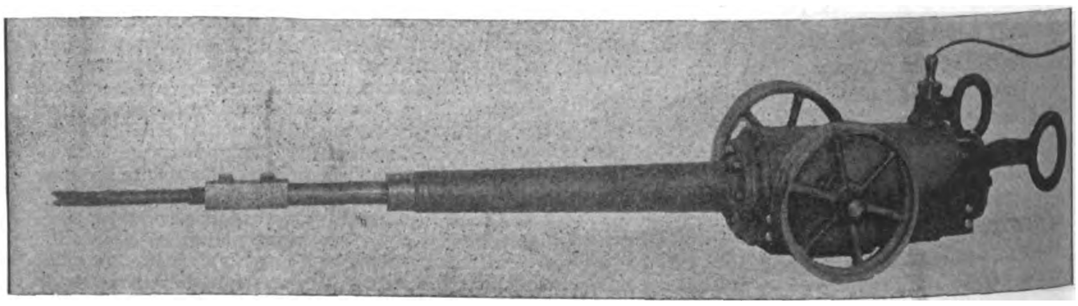
tached to and moves with the radial arm, and is so arranged as to just balance the weight of the drill gear.

The apparatus is capable of drilling holes up to 1¼ inches diameter in iron and steel, and would seem to be applicable to advantage in many places where drills of such sizes are used.

A SOLENOID COAL CUTTER.

In some grades of coal it is found desirable to make the undercut with a machine concentrating its power upon a single reciprocating shaft, carrying a chisel at its extremity. This type of cutter or drill is very compact and is controlled by one man, the direction of the blow being varied as occasion demands. Several machines of this type, operated by steam or compressed air, are on the market, and while in many ways satisfactory, the application of electricity as the motive power possesses many decided advantages.

The accompanying illustration shows the Van-Depoele solenoid coal cutter, manufactured by the Thomson-VanDepoele Electric Mining Company, of Boston. The type shown is the present standard form, though modifications can be made to suit special requirements. The operation of the cutter may be easily understood from an inspec-



SOLENOID COAL CUTTER.

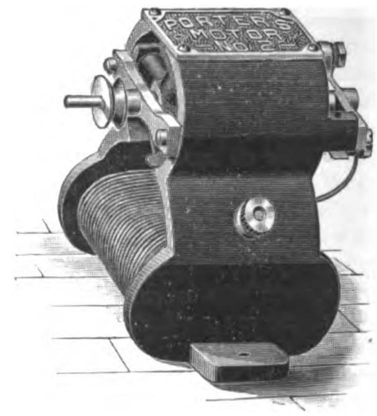
tion of the illustration. The direction of the blow is determined by the operator, who sits on the floor facing the breast of the working, his feet resting against the wheels, and his hands grasping the handles at the rear of the cylinder, by which the machine, being almost exactly balanced, is easily turned on its points of support.

A simple switching device turns the current on or off as desired. Lights, pumping apparatus, electric ventilators, etc., may be run on the same system of wires which supply power to the coal cutter, if necessary.

The weight of the apparatus is a little over 700 pounds. The number of strokes usually ranges from 300 to 350 per minute, although the rapidity of the blow can be varied at pleasure. The stroke is from five to six and one-half inches. The tension guide can be furnished in different lengths, according to the depth of undercut desired. Quite a number of these machines are now in operation.

PORTER MOTOR.

The small motor shown in the cut is sufficiently large to perform useful work. It can be operated by a battery, and can, therefore, be utilized where a small amount of power is required. No. 3 motor with four cells develops about one-twelfth horse power when running at 2,200 revolutions per minute, and will operate an ordinary sewing machine or a small ventilating fan. The machines are well built, the armature consists of two sections on a steel shaft. These sections consist of three segments, each segment resembling a simple Siemens armature, made of annealed cast iron.



PORTER MOTOR.

The field magnets, two in number, lie horizontally at the base of the motor, with vertical pole pieces extending from them, which are curved at the upper end to conform to the shape of the armature. The fields are wound in such a manner that they both give the same polarity at the adjacent ends. The Electric Gas Lighting Company, of Boston, is putting the motor on the market in New England.

UTILIZATION OF WATER POWER FOR ELECTRICAL PURPOSES.

Herr Zipernowsky proposes to put into operation in Vienna an electrical street railway plant that involves some novel features. He suggests an electrical system of distribution in which both continuous and alternating currents are to be used: An alternating generator giving current at 10,000 volts will be located some distance from the city where water power is cheap, and the energy produced will be transmitted to a motor in a secondary station. This motor which will have to be started by a separate machine, and will have to be kept in operation by the latter until it becomes synchronized or in step with the generating alternator, will actuate a continuous current dynamo. The latter will then supply current for the motors driving the cars.

This combined system will allow of the utilization of water power too distant to permit of the exclusive use of a continuous current method.

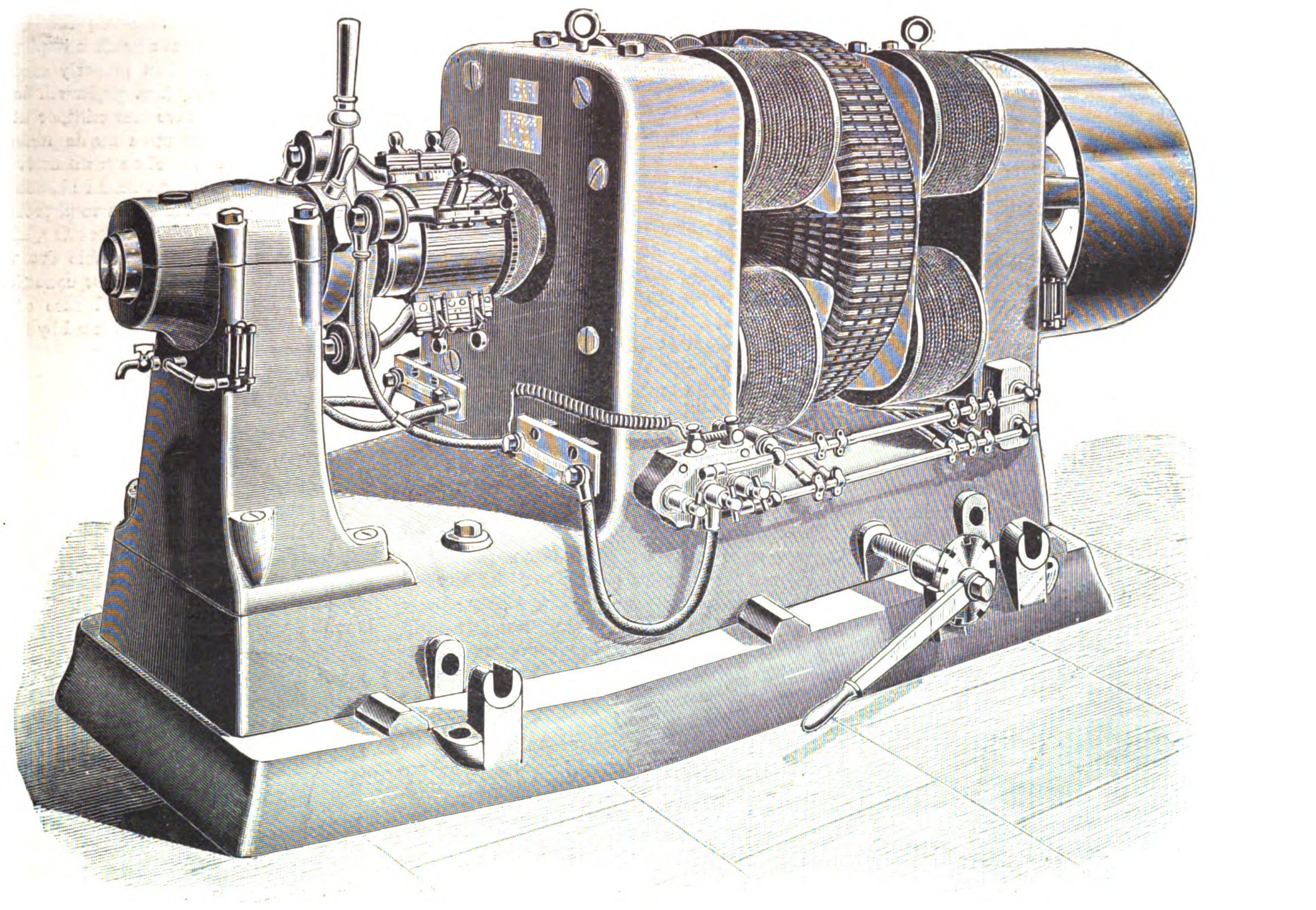
NEW SHORT RAILWAY GENERATOR.

The Short Electric Railway Company, of Cleveland, has just brought out the first of a new series of railway dynamos which are massive in form, simple in construction and admirably constructed.

The illustration gives an excellent idea of the 150 horse power generator, capable of delivering in continuous service 225 amperes at a pressure of 500 volts, equivalent to a total electrical output of 112,500 watts, and having, in fact, a reserve capacity above the normal of at least 30 per cent in both current and voltage. The magnetic frame is composed of a single casting and weighs over 800 pounds. To this heavy frame are bolted eight field magnets, carrying the shunt and series coils and provided with pole pieces of peculiar shape arranged for side presentation to the armature and so disposed as to make a powerful and almost perfectly uniform field of force with a narrow magnetic gap of large diameter.

Within this space revolves the armature, which is a distinctive feature of the machine. Its peculiar construction is well known to all who are familiar with the past practice of the Short Company. Upon a shaft, nine feet long by six inches in diameter is keyed a massive spider carrying the foundation ring upon which the armature is built up. The armature core is formed of thin sheet iron wound spirally on the foundation ring and riveted firmly together. The outside circumference of the ring is somewhat wider than the remainder, and this portion is milled out into notches forming a modified Pacinotti ring. The coils are then wound on the core around the hollow ring, the method being such that each and every one of the 200 coils is entirely exposed to the air on all sides, thus securing ventilation which is obtainable in no other type of armature. As a consequence both armature and field run cool and it is almost impossible to burn out a coil even with heavy overloads. Moreover, the destruction of a single coil does not affect adjacent coils, and it is even possible, in case of necessity to run the machine several days without rewinding a burned-out coil. A burned-out coil can be wound by any good mechanic at a cost of two or three dollars and a half day's labor. One of the most noteworthy features of the armature is its large diameter, viz: 36 inches.

The details of construction are carefully worked out. The armature shaft runs in large self-centering and self-oiling bearings, the lubrication being accomplished by rings carried by the shaft and drawing oil from a reservoir in the usual way. At the commutator box is also found an adjustable ball bearing thrust collar containing several hundred balls, and so arranged as to carry the armature thrust in either direction without the slightest heating. This is an entirely novel feature in this class of machinery. The electrical properties of the machine are quite as noteworthy as the mechanical. The magnets always work far below the saturation point, even at heavy overloads. The compounding has been so carefully calculated that the pressure curve is a straight line, passing from 500 volts at no load to 525 volts at full load, with speed maintained constant at 500 revolutions.



Short Railway Generator.

The Short Company is building this type of generator in five sizes, viz: 75 H. P., 100 H. P., 150 H. P., 300 H. P. and 500 H. P. The last named size will run at about 100 revolutions and will be connected direct to a vertical compound engine, thus doing away with all belts and shafting. It is probable that even larger sizes will be built later on, to accommodate the heavy railway work which is immediately in prospect.

Frederick Brown, who was delegated by the authorities of Wolsall, England, to report on the American system of electric railways, says: "With the improved motors and gear I heard of complaint of their not making noise enough!"

ELECTRICAL CURRENT TOPICS.

Residents of Brockton, Mass., propose to hold afternoon parties on the electric cars. They intend to charter an ordinary car and place several wide boards for a table over the backs of the seats in the center. They will swing around the circle until they desire to stop. As the Brocktonians do not object to the publicity of the ride, the oddity of suppers under such circumstances will make these parties successful.

* * *

The *Electrician* (London) bewails thus the lack of electrical enterprise in street railway construction in Great Britain: "A large and varied assortment of reasons can readily be marshaled up to account for the rapid development of electric traction in the United States and its snail-like progress in the United Kingdom. If a reproduction of the results obtained with electric cars on the Boston West End Railway could be guaranteed on this side the Atlantic—and we know of no insuperable obstacle—even the most cautious of tramway directors might be induced to emerge from the experimental stage."

* * *

The foreign papers have devoted a great deal of attention to Nikola Tesla's paper on experiments with alternating currents of high frequency. The paper was well worthy of all their comments. Mr. Tesla will be interested in reading the conclusion of the article in *La Nature*. After giving the concluding portion of Mr. Tesla's paper, in which he speaks of the significance of his experiments, the French paper says in this part of the article the writer ceased to be the learned scientist and became for the moment a poet.

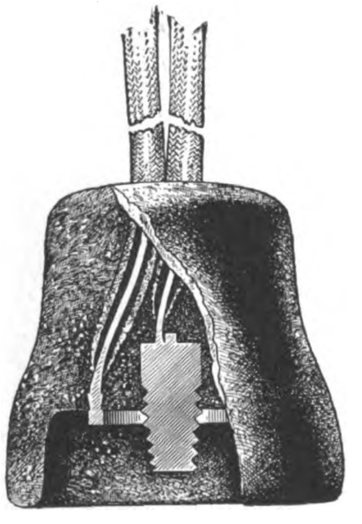
* * *

An interesting instance of the successful application of electricity as a safeguard against fire, came to the surface in connection with the burning of the great fur house of Burkhart & Co., at

Cincinnati, recently. This building was supplied with an automatic detector, which was electrically connected with the central fire tower as well as to police headquarters. At the time of the fire the night watchman was in the basement, where the fire originated, and heard the fire bells strike the number of the box nearest the establishment. He continued his rounds, and was totally unaware that the building was on fire, until he was called to the iron doors leading to the street, at which the firemen had been pounding for some minutes to gain admission. The fire had been detected, the alarm given and the engines were at the door before the watchman within the building knew that anything was wrong. Another illustration comes from New York. A few weeks ago Manager Nicholson discovered that the safe in the office of Lawyer John Townsend in the Bennett Building was being systematically robbed. Inspector Byrnes was consulted, and upon investigation it became evident to him that the safe was being robbed by some one having a key to it. The safe was so located as not to afford a place of concealment from which it could be watched, so some other method of detecting the thief had to be resorted to. The inspector hit upon the expedient of drilling a hole back of the safe, running a wire through it and attaching it to the money drawer inside. This wire was placed in circuit with a battery and burglar alarm, situated in a distant room. The opening of the drawer would ring the alarm, and the inspector's men in waiting would rush in and seize the thief. The first night the detectives awaited in vain; but on the next evening they were rewarded by the tinkling of the bell, and on rushing into the office caught the porter, Otto Thunstrom, in the act.

WATERPROOF-KEYLESS SOCKET.

Among the devices made of the Lehte insulating compound used by the Gould & Watson Mica Company, of Boston, is a waterproof keyless socket for incandescent lamps, a cut of which is shown herewith. The illustration represents a socket



Keyless Socket.

made for a Thomson-Houston lamp with wire moulded into the material itself in such a way that the socket is entirely waterproof on top, while a rubber ring which fits closely between the lamp and inside of the skirts prevents moisture from getting in below. An extension is also provided for Edison lamps. Being acid proof, this socket is especially adapted for paper mills, dye houses, and other places where moisture or acid will affect an ordinary socket.

SAFETY AND RAPID TRANSIT.

Speaking of safety and rapid transit in cities, the *Engineering News* says: From all the data available it may be concluded that those who would increase the safety of electric or cable street cars and thus make practicable higher rates of speed than those now attained, have the best opportunities of success by improving the ordinary brake gear, increasing its strength and stiffness, and applying power to move it in place of the driver's muscle; in short, just the methods by which the brakes on steam railways have reached their present efficiency. The urgent need of action in this direction has, we believe, been made sufficiently clear.

STORAGE BATTERY INSURANCE.

It is well known that the secondary battery has come into much more general use abroad than in this country. The reason is not at first apparent. The surprise is, not that it has been more often employed there, but that it is used less here. In England, Germany, Belgium, and France it is considered almost an invaluable adjunct in direct current electrical supply, permitting, as it does, the continuous operation of the dynamos at their most economical load, irrespective of fluctuating demands.

In this country the secondary battery is still looked upon with suspicion, and that it is not yet as popular as it is abroad is probably largely due to the fact that we, as a people, have not yet learned to give it proper care and attention.

That our storage batteries are equal in every respect to those of foreign make has been amply demonstrated by results obtained by them in the hands of their exploiters and others who understand their proper management. But the fact remains that when they have been put into commercial use they have not given the unqualified satisfaction which had been hoped of them.

On this side of the Atlantic we are apt to expect too much of a machine and give it too little care. This is true of ourselves. There is no people in the world which strains its mental and physical powers to the extent that Americans do, and it is, perhaps, but natural that we should extend this treatment to our creatures.

The continuance of this practice has resulted in a race more capable of withstanding the rough usage—not through the principle of the survival of the fittest, for there are probably fewer failures here than elsewhere, but through a gradual adaptation to our environment which the plasticity of the American organization renders possible. "As the creator so the creature," and we have long been successfully subjecting our dynamos and motors to treatment that would be considered outrageous abroad, but which has resulted in a hardy type or types of machines unexcelled for general purposes by those of any foreign countries.

The storage battery, however, is still in its infantile state, as far as development is concerned, and is not yet able to withstand all the kicks and cuffs that it is subjected to in this cruel world, but still requires intelligent protection and care. It is probable that the exigencies of the times will ultimately result in a hardy and robust battery too, that will be able to take care of itself notwithstanding the continued abuse to which it is subjected. That much-desired end has not yet been accomplished and in the mean time any suggestions that will tend to ameliorate the existing state of affairs, that will enable us to employ the storage battery with sufficient confidence to use it in commercial work on a large scale will be hailed with satisfaction.

Such a suggestion comes to us from London. There "the Foreign and Colonial Power and Storage Company" has formed, as one of its departments, a sort of society for the prevention of cruelty to storage batteries.

They have decided to advance on the principle of insurance for life and maintenance of secondary batteries, and by taking a considerable number of batteries (or risks) under their care, (on the principle of human life insurance) to make the good contribute towards the extra cost of the bad. They propose to make different terms for maintenance according to the arrangements provided for charging and the kind of work done on discharge. Before taking risks or insurance they will send an expert to inspect the battery, engine and surroundings including, probably, the attendant in charge, and the premium charged for maintenance will be gauged by the result of this examination.

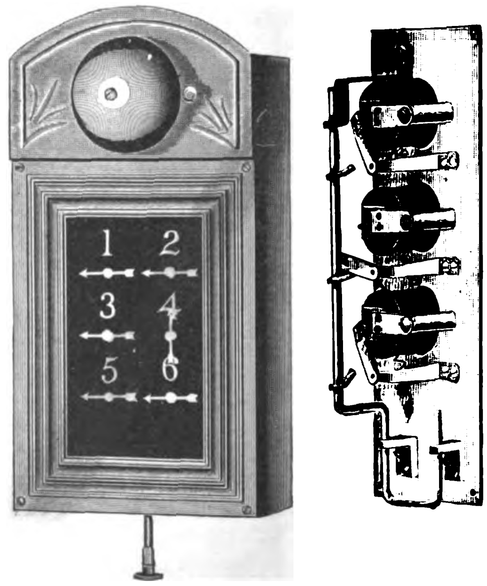
This is certainly an excellent idea as it will result in the discharge of incompetent hands, and as the company will be vitally concerned in intelligent supervision of the plants, it will be to their interest to instruct those upon whom their success will so largely depend, and thus raise the standard of employes engaged in storage battery management—a consummation much to be desired. For an important battery such as is employed at central stations, they express a hope to effect an insurance at a charge not to exceed 8 per cent per annum on the first cost.

If this can be done at a profit it implies a life to the storage battery when properly cared for of not less than twenty years. This will be a revelation to many who have blamed their ill success with storage batteries upon the imperfections of the instrument instead of upon themselves, whom they have held blameless. As a rule, however, the company expects its charges to be from 10 to 20 per cent.

For such work it is reasonable that the company should desire to make it a condition of insurance that the charging and care of cells be supervised by some one nominated by itself. This would seem to be a desideratum to the owner of the plant as well as relieving him of all responsibility in the premises.

NEEDLE ANNUNCIATOR.

The Hub needle annunciator is shown in the accompanying cut. The device was made to supply a reliable instrument at a relatively small cost. The annunciator is introduced by the Electric Gas Lighting Company, of Boston. A single magnet operates a gravity needle drop, which is replaced by a mechanical set-back. The drops are mounted on a metal base, which cannot warp or



Needle Annunciator.

shrink so as to throw the mechanism out of adjustment. The whole is arranged very simply, as may be seen from the accompanying cuts, one of which shows the exterior, the other the internal arrangement of the operating mechanism. It has few parts and they are easily accessible for repairs or adjustment, and the device occupies small space. Little battery power is required, it is claimed, and it is said it will act with certainty in all seasons and temperatures.

MAGNETIC RESISTANCE OF JOINTS.

Prof. J. A. Ewing, F.R.S., gives in the following figures the magnetic resistance of joints, both when the surfaces of the joint were placed in simple contact and when they were pressed close by externally applied force. An iron bar was first tested without any cut, and then when cut in the middle into two parts, the ends of which were carefully scraped to form true planes before being put into contact. The truth of the surfaces which formed the joint was tested by comparison with a Whitworth surface-plate.

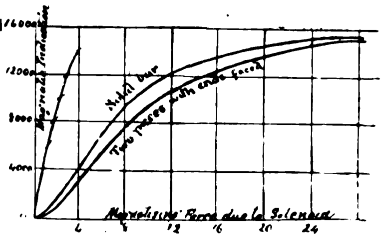
Notwithstanding the closeness of contact which this procedure insured, the joint was found to offer a very appreciable amount of resistance, as the following figures will show.

INFLUENCE OF A SMOOTH JOINT IN REDUCING THE MAGNETIC INDUCTION IN AN IRON BAR.

MAGNETIZING FORCE DUE TO SOLENOID.	MAGNETIC INDUCTION.	
	Bar Uncut.	Bar Cut in Two Pieces with Surfaces of Joint Faced to True plane.
4	3950	3000
6	6900	5000
8	9250	7400
10	10900	9150
15	13250	12000
20	14300	13500
30	15200	14900

By plotting these data—the horizontal distances representing the magnetizing forces employed, and the vertical spaces the corresponding magnetisms induced in the bars—the two curves shown in the cut are obtained.

The straighter curve to the left shows the additional magneto motive force required to produce



the same induction through the joint, or, in other words, represents the resistance offered by the joint to the various degrees of magnetic induction.

It will be noticed that this latter, although nearly a straight line, curves slightly outward, seeming to indicate a slightly greater equivalent air gap in the region of higher magnetization, but as a very slight error in one or the other of the two curves from which this is derived would suffice to account for this, it is probably due to such errors. This idea is strengthened by the fact that in another experiment this same line turned slightly inward.

It appears therefore that this joint is equivalent to a narrow strip of air, the width of which is at least not far from constant for all degrees of magnetization.

The following are the widths of this gap, calculated for the experiment above mentioned, and the accompanying curves.

MAGNETIC INDUCTION.	WIDTH OF EQUIVALENT AIR-GAP IN CENTIMETERS.
4000	0.0026
6000	0.0030
8000	0.0031
10000	0.0031
12000	0.0035
14000	0.0037

The equivalent air gap in the above experiment may be represented fairly by .0033 centimeter, and this agrees within the limits of error of observation.

It is difficult to believe that such a gap really exists, and Prof. Ewing thinks it probable that the resistance of the joint is due in part to a diminished permeability of the metal itself at and close to each surface, but the influence of compression on such a joint which is detailed below would seem to disprove the existence of any lessened permeability in the metal itself, and to show that the resistance was due to other causes.

INFLUENCE OF COMPRESSION ON MAGNETIC RESISTANCE OF A JOINT.

Since the permeability of the metal itself is changed by compression, the influence of the joint to be tested was arrived at by comparing the resistance of the cut bar under pressure with the resistance of the uncut bar under equal pressure.

The compression was applied to the bar in both cases by means of a weighted lever at the top.

It was found that the effect of pressure is to lessen the magnetic resistance of the joint, so much so, indeed, that when the surfaces composing the joint are true planes, a tolerably strong pressure almost wholly destroys the resistance due to the joint.

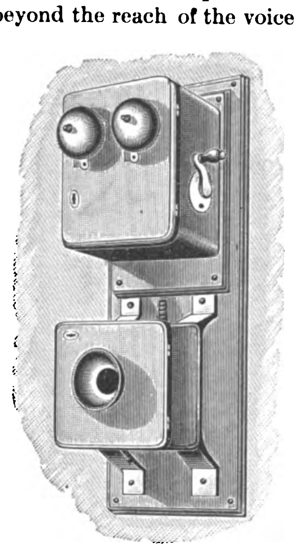
This effect was produced almost completely by a pressure of 226 kilogrammes per square centimeter. Smaller loads produced diminished effects, and progressive reduction of resistance could be traced as the loads were increased.

The following table gives the values of the magnetic induction observed in an iron bar, first when solid and then when cut with faced ends, under various stresses and constant magnetizing force, viz: 5 C. G. S. units.

STRESS IN KILOS PER SQUARE CENT.	Magnetic Induction Produced in each case by Magnetizing Force in Coil of 5 C. G. S. units.	
	Before Cutting.	After Cutting.
0	5600	4700
56.5	5400	4670
113	4700	4200
169.5	4050	3800
226	3650	3650

SHORT DISTANCE TELEPHONE.

Since the advent of the telephone the ability to converse beyond the reach of the voice has grown



SHORT DISTANCE TELEPHONE.

to be almost a necessity. Where long distances are concerned there is nothing of course that can take the place of the electric telephone, but there are innumerable cases where it is desirable to establish communication over shorter distances, such as between the office and the several floors or buildings of a manufacturing establishment, or between a residence and a barn, where other devices which can be bought outright at small cost, and which are so simple in construction as not to be subject to disarrangement, answer the purpose well, and are within the reach of all. Among these is the Pulsion telephone, a cut of which is herewith shown. In this device, behind the diaphragm, are a large number of sensitive springs which take up the sound vibrations of the voice and impart them to the line wire. A similarly arranged diaphragm at the receiving end takes up these vibrations and imparts them to the air again with great fidelity. No electric current is used and therefore the care of a battery is dispensed with. The Massachusetts Pulsion Telephone Company is exploiting this system.

FROM NEWS CENTERS.

NEW YORK.

NEW YORK, AUG. 29.—Many signs are constantly becoming manifest that New York is gradually waking up to the conviction that it cannot longer afford to lag behind every other city of pretensions in the country in the matter of electric traction. Frank Curtis, president of the Sixth avenue surface railroad, was recently interviewed on the reported intention of his company to substitute some other form of motive power for horse-power. He said it was quite true that such a change was contemplated, but what the new power would be was not yet decided. He stated that the company was watching the operation of cable and electric railways, and waiting for further developments in both systems, and especially the latter. Although inclined to regard the cable system with some degree of favor he could not ignore its great expense, and realized that if the cable were adopted they might find themselves at any moment confronted with the necessity of superseding it by electricity. He alluded to the change in the situation with reference to electric propulsion which the recent decision in the litigation over storage batteries has made and the extent to which it had simplified matters for the company so far as future changes are concerned. He added: "We also understand that electricity is already cheaper than cable traction, and we know that electricity is daily becoming cheaper and more efficient. However, we have not yet decided, and have gone so far in the cable direction as to get the Broadway company to lay our crossing at Thirty-fourth street, as if for the cable system. We shall, at all events, make no change this year." Certain marked developments are now being made in electric conduits, which, when given to the public, will make it more than ever evident that the laying of a cable road will come to mean, in the majority of cases, taking the first step towards the adoption of electric traction. The transition will soon be attended by but little difficulty and expense and that this is beginning to be recognized is shown by the waiting policy to which Mr. Curtis refers, and which is now being adopted by so many street railway companies who contemplate a change in their method of traction.

It would seem as if the Rapid Transit Commission was determined to see just how far it can try the sufferance of the people of New York City. There was to have been an important meeting on Tuesday, but the meeting did not take place because the members of the commission were out of town. The discontent with which the inaction of the commissioners has long been regarded is growing, and indignant comments on the situation are heard on every hand. A representative owner of real estate in this city, thus, in expressing his own opinions, gives expression to the general feeling on the subject: "The summer is nearly gone and the commission has accomplished practically nothing. It does not look as if we will have anything but the elevated roads in the next five or six years. Everything is in doubt when we expected definite assurance by this time. The plans published are of too general a nature to amount to anything. There seems to be no attraction for capital, and the impression is growing that the work of the commission will be chiefly confined to planning things which will not be executed." One of the most serious effects of this trifling with the interests of the public is that the people in the northern part of the island are beginning to think that it is better, after all, to give the Manhattan Elevated Company what they ask for, for the purpose of extending their system; here at all events, is quick if only temporary relief, while the prospect of real rapid transit is dim and distant. Concerning the vacillation of the commission, the *Times*, which for years has been an earnest and temperate advocate of rapid transit, says: "The more the Rapid Transit Commission's change of purpose in regard to the underground railroad in Broadway is considered, the more unaccountable it seems. We can only wonder at it, and await with no little anxiety the promised details and arguments that are to justify it. At present it looks as if the success of the whole scheme of rapid transit for which we have waited so long might be at stake in the decision of this question."

A statistician, in comparing Eastern and Western cities, finds that where the East leads the West most markedly is in relation to street lighting. New York and Brooklyn have respectively 671 and 412 lamps to each square mile of the city; Chicago has but 204 and St. Louis 67. Brooklyn has 1,500 electric lamps to 1,379 in New York and 422 in Chicago. The points which he says these figures suggest are: "New York, of course, is the standard. Brooklyn's electric light trust accounts

for her excess of these lamps, while Chicago, with its gas trust, turns its back on electrical illumination." G. H. G.

BOSTON.

BOSTON, Aug. 28. The Thomson-Van Depoele Mining Company has just secured contracts for the installation of two electric mining tramways, including locomotives of twenty-five horse power each and full track equipment, for Southern Pennsylvania. The same company has recently shipped a sixty horse-power mining locomotive for haulage purposes to a coal mine company in Tioga county, Pa. This locomotive stands 39" high from the track. It is provided with four electric headlights. The controlling devices were specially designed and duplicates of them will be used on all locomotives in the future. At the factory two other locomotives of sixty horse power and forty horse power each are approaching completion.

The Norfolk & Suffolk Street Railway Company is a strong corporation which is seeking a franchise for the construction of an electric railway in Hyde Park, a flourishing suburb of Boston. A hearing has already been given by the selectmen and it will be resumed in a few days. Congressman J. H. O'Neil is one of the petitioners.

A petition is to be presented to the Cambridge aldermen at their next meeting by the West End Railroad Company for authority to extend its electric system in that city.

Last Sunday the new electric railway connecting Worcester, Leicester and Spencer, Mass., was opened and over 4,000 passengers were carried. At times the crowd was so great and unmanageable that police assistance had to be procured, and several of the cars got badly strained by reason of the tremendous loads they carried.

The electric railway between North Nasselboro and Waterville, Me., will soon be an accomplished fact. Several capitalists who are noted for their enterprise have taken hold of the project.

The Hon. J. E. Fitzgerald, a member of the Rapid Transit Commission, has been selected to visit Europe to examine into the merits of the various systems now in operation. He will visit Liverpool, Birmingham, Brussels, Paris, Glasgow, Hamburg, Berlin and other cities on the continent. In London special attention will be given to the tunnel or Greathead system; in Glasgow, to the viaduct, and in Berlin, to the elevated road.

Professor Elihu Thomson is achieving singular success with his newly devised method of case-hardening iron or steel by means of the passage of an electric current. His process consists in heating the article electrically, and then applying to the metal so heated a surrounding envelope—either gaseous, fluid or solid for the purpose of changing or preventing change in the quality of the material, according to the special end to be attained.

The Morning Star Publishing Company, of this city, is now operating all its printing presses and other machinery by a C. & C. electric motor, and is more than well satisfied with the change it has made from steam to electricity.

The movement in electric stocks on the Boston market is gaining strength every day, and indications warrant the belief that the result will be an actual boom ere long. Thomson-Houston, of course, takes the lead, being closely followed by Westinghouse, Detroit and Fort Wayne. The advance movement has extended to Thomson-Houston series D. Confidence is increasing right along in the approaching successful advance of the Westinghouse reorganization plan, and while the movement is progressing very quietly, the business and sales of the company are showing a steady increase and every one interested is hopeful.

The vacation season hereabouts still continues and many prominent New England electricians are absent from business. As they return one by one, however they are more than gratified to find that there is a decided change for the better all around, the outlook for good business being more than promising. Already some good fall contracts have been closed in this city and other parts of the New England States.

It is reported that a New York firm has secured property in Waltham, Mass., and will erect a factory for the manufacture of electric street cars.

The Schuyler Electric Company, of Middletown, Conn., has secured the services of Mr. Knowles, late of Brooklyn, N. Y., as chief electrician.

James A. Jenney, of the Fort Wayne Jenney Electric Company, and A. W. Rounds, president of the Russell Electric Company, Boston, are identified as president and treasurer respectively, of the Jenney Star Electric Company, which has secured a factory at New Bedford, Mass, and will almost directly commence the manufacture of Jenney motors, dynamos, and other electrical apparatus.

The new Harvard bridge spanning the Charles river and connecting Boston and Cambridge is to be opened for traffic on Tuesday, September 1st. It has been examined by experts and is expected sooner or later that the draw will be operated by an electric motor.

The Edison Illuminating Company, of this city, is to increase the capacity of its Head Place plant. W. S. K.

CINCINNATI.

CINCINNATI, OHIO, Aug. 27.—The city of Newport, Ky., has contracted for illuminating the public streets, with two companies, viz: The Suburban Illuminating, Heat and Power Company, with electricity, and the Newport Light Company, with gas and gasoline. The contract with the latter company was rescinded after the one with former company had been entered into; but the action of the council was disputed and the legality of the question has never been settled. In spite of these three modes of lighting, the city is left in darkness on cloudy nights during full moon as both contracts are on the moonlight schedule. The city pays $100 per light per year on the moonlight schedule.

The South Covington and Cincinnati Street Railway Company have installed a turn table at the Newport terminus of the new bridge across the Ohio River and will run motor cars from Fountain Square to the end of bridge and transfer to horse cars in Newport. They will secure power from the Cincinnati Street Railway Company's Pendleton line.

The overhead construction work of the Elm Street and Pendleton line is about completed. The eastern division of this line is now in operation.

A Colerain avenue electric car and a Lion Brewery beer wagon came together last week turning the wagon completely over and smashing it to pieces. The driver of the wagon was badly hurt about the legs.

Capt. G. N. Stone, after visiting several cities where telephone companies have successfully used conduit systems, has perfected his plans for a system for underground telephone wires in this city. He submitted his plans for a telephone subway to the Board of Administration Tuesday morning and stated that he wanted to begin work by the first of next month. Five years will be consumed in completing the work. Conduits and distributing pipes will be laid in alleys so far as it is possible. The Albany building has been secured by the Telephone Company and plans for remodeling and enlarging the building will be prepared by Samuel Hannaford & Sons, architects. A model exchange with latest improved switchboards will be constructed.

Long distance metallic telephone service, connecting Cincinnati with all the principal cities will be one of the features of this new equipment. The Long Distance Telephone Company is now engaged in extending its poles and wires to this city.

Metallic circuits have been completed between this city, Hartwell, Wyoming, Glendale and Hamilton, Ohio. Long distance metallic circuits are now being constructed from this city to Dayton, Springfield and points beyond.

J. C. Randall was not very successful in his first attempt to fly his air ship. The supporting balloon had been exposed to a heavy rain on the day the trial trip was to be made, causing a heavy leakage of gas. The present propellers of this air ship are operated on the same principle as the wheel of a bicycle. Mr. Randall intends to runs his ship by electricity and believes he can go up to a considerable height. On his first trip he went up two hundred feet.

The Hamilton, Lindenwald and Electric Transit Company, of Hamilton, Ohio, have closed contracts for iron, ties and ten new cars within the last few days. The contract for constructing the new extension was also awarded. The work of completing the new line to the Fair Grounds will be commenced immediately upon arrival of material.

A trolley wire on the Mount Auburn Electric line broke on the curve at Fifth and Walnut streets yesterday, and a mule in a Newport car was shocked in consequence. The Mount Auburn cars were compelled to make the curve for some time on the "momentum plan."

During the performance of the "Last Days of Pompeii," Sam Miley, the electrician, was knocked insensible by coming in contact with the arc wires. He recovered after a short time.

The South Covington and Cincinnati Street Railway Company put a sample Thomson-Houston motor car equipment, last week, on the Green Line. With the exception of this Thomson-Houston car, the Short system is used throughout. T. J. C.

PHILADELPHIA.

PHILADELPHIA, Aug. 26.—Preliminary work for the location of torpedo stations on Fort Delaware Island and the New Fort opposite below Delaware City, has been begun by Major Raymond of the United States Army Engineer Corps, and his staff. The proposed works are for the protection of the Delaware Bay ship channel and are to form a part of the Atlantic coast defenses. The proposed forts will be of earth works with galleries and subterranean passages running out on the bay to the point where it may be thought necessary to launch the electric torpedoes. The money for the new stations was included in the appropriations of the last Congress for coast defenses. No detailed information can be furnished as the plans are kept secret.

Walker & Kepler are about putting some $20,000 worth of the Edison Company's fixtures in their store for display.

The Empire Theatre will be opened next week. The electrical work is the most complete and elaborate of any plant in town.

Inside of a year the Reading Railroad expects to have a magnificent station at 12th and Market Streets, the heart of the town. The last two important properties two market houses were bought for the neat sum of $1,000,000. Work is carried on at night by the aid of the electric light. The block on Arch Street looks as if it had been the path of a cyclone. Fine old family mansions have been razed to the ground and already the massive masonry of the foundations appears in sight. In two cases, families refused the Reading's offers to buy and as they would not move, the houses were pulled down over their heads, their goods carefully moved and stored away, and the irate tenants compelled to seek other quarters. A complete electric plant is to be installed to furnish light to the station and also to the new market which will occupy the ground floor.

A new Masonic Temple is to be built in Camden. Plans have been furnished and accepted, which call for a massive structure to be used as lodge rooms and a theatre. The theatre part is something new for Camden, which has heretofore had to depend on Philadelphia for its amusements. The building will be thoroughly lighted by electricity, but it is not decided whether a separate plant will be installed or current secured from the electric light company. A. P.

DETROIT.

DETROIT, August 29.—A second trial trip of the Logan storage battery car of the Standard Electric Company was made on the track of the Grand Trunk last Sunday. The start was made from the Milwaukee Junction at 12:20 and the run to Mt. Clemens occupied one hour and fifty-five minutes. This included a stop at Fraser and a dozen delays caused by the fact that the frogs at the switches were too deep for the wheels and the car had to be brought to a standstill at each one while iron plates were laid down for the car to run over. The actual running time for the seventeen miles was very little more than one hour and twenty minutes. There was no lack of power, the current was easily controlled, stops and starts were made without jerk or jar and altogether the trip was an entire success. The motors on the car are the Shawan motors, used on Fort street a year ago. They worked easily and smoothly.

G. H. Gale is still enthusiastically engaged on the Woodward storage battery car, which is now at the Pullman works in this city. It is announced to run for one week on the Jefferson avenue line. Its advent is expected any day.

The Edison Company is putting in an electric light plant at the House of Correction.

The Electrical Equipment Company, which had charge of the illumination of the city hall during G. A. R. week, is fitting up the new Schwankovsky conservatory of music with 400 incandescent lights. The interior of the building is patterned after the Auditorium, of Chicago, and is very handsome. V. W. R.

MONTREAL CONVENTION.

The best route for intending visitors to the coming Electric Light Convention at Montreal is undoubtedly the Chicago & Grand Trunk Railway, their fast limited trains leaving Dearborn Station, Chicago 3 P. M. and 8.15 P. M., arriving in Montreal the following night and second morning, respectively.

Tourists tickets via this route, will give the

holders the option of taking in Niagara Falls and the river trip down the rapids of the St. Lawrence from Kingston to Montreal, without any extra charge. Full particulars can be obtained from the offices of that company, 103 Clark St., Chicago, Ill.

WHAT IS SAID OF "ELECTRICITY."

Electrical Message.

It is a typographical beauty, well and handsomely illustrated, and amply evidences its belief that there is still room for another. ELECTRICITY will not fail to interest.

Street Railway Review.

It is handsomely printed and full of interesting matter. We wish the new candidate all possible success.

London Industries.

It is well printed and illustrated, and contains several ably-written technical and popular electrical articles. Though published in Chicago, it is not to be local in any way, but aims at covering a large ground. Considering the size and excellent appearance of our new contemporary, it is extremely cheap. We wish it the success it certainly deserves.

Street Railway Gazette.

With perfect style in matter and manner this new venture is issued from the World's Fair City.

INCORPORATIONS.

The following new companies have been incorporated:

Roland Ave. Electric Railway Company, Baltimore, Md.; capital stock, $25,000; promoters, A. H. Rutherford, C. O. D. Lee, Douglass H. Thomas.

The West and South Towns Horse Railway Company, Chicago, Ill.; capital stock, $100,000; promoters, C. L. Bonney, L. C. Bonney, M. A. Bonney—all of Chicago, Ill.

The Circleville Light & Power Co., Circleville, Ohio; capital stock, $100,000; promoters, Chas. J. Delaplane, Howard Jones, N. E. Jones, Fannie M. Moore and J. L. Stribling.

Cœur d'Alene City Illuminating Co., Cœur d'Alene City, Idaho; capital stock, $20,000; promoters, M. R. Kellinger, Chas. D. Barry, B. Mahlum, W. L. Gleason, Portland, Ore.

Bradshaw Lumber Company, Suffolk, Va.; capital stock, $50,000; to operate water, gas and electric light works, lumber mills; promoters, W. H. Bradshaw, W. H. Jones, Jr., C. W. Jenkins, J. I. Gray, E. E. Holland.

Red Oak Electric Company, Red Oak, Iowa; capital stock, $20,000; to supply electricity for light and other uses; promoters, W. H. Blood, Kansas City, Mo.; A. M. Miller, F. H. Hutchinson, Red Oak, Iowa.

Jenney Star Electric Company, Portland, Maine; capital stock, $50,000; to manufacture motors, dynamos, batteries and machinery; promoters, Edward E. Bowker, New Bedford, Mass.; James A. Jenney, New Haven, Mass.

The Wright and Starr Electric Company (incorporated in W. Va.), Philadelphia, Pa.; capital stock, $250,000; to manufacture electrical appliances; promoters, Benj. F. Morley, Chester, Pa.; E. E. Starr, 37 S. 3rd st., Philadelphia, Pa.

East Side Land Company, Goshen Va.; capital stock, $25,000; real estate, mines and quarries, gas, electric and water works, street railways, etc.; promoters, J. R. Jones, C. W. Jones, A. D. Smith, Jr., A. Alexander, T. A. Browning, Jr.

The People's Electric Street Railway Company, of Beaver, Pa.; capital stock, $50,000; to construct and operate a street railroad from Bridgewater to Economy Township, Beaver Co., Pa.; promoters, Hartford P. Brown, Rochester, Pa.; Dan H. Stone, Jas. P. Stone, Beaver Falls.

Northwestern Street Railway Company, Chicago, Ill.; capital stock, $25,000; to operate street railways in the towns of Leyden, Proviso, Cicero and Maine and the City of Chicago, by any motive power except steam locomotives; promoters, Eugene B. Weeks, John L. Pearson, Alfred A. Ellsworth.

Piedmont Spring Water and Power Company, Oakland, Cal.; capital stock, $1,000,000; to operate a system of water works within the county of Alameda, and to construct and operate machinery for generating electricity; promoters, E. H. Benjamin, W. F. Boardman, E. G. Vincent, W. J. Dingee, of Oakland, Cal.; and Geo. D. Metcalf, Berkeley, Cal.

LIGHT.

West Duluth, Minn., has abandoned the project of purchasing an electric light plant.

A plan to place electric lights along the popular Whitefish Bay road, Milwaukee, is talked of.

The Colorado Springs Electric Light Company is to build an addition to its plant at a cost of $35,000.

Carthage, Ill., wants to be illuminated by electricity and an effort is being made to organize a company with $10,000 capital stock to furnish the lights.

An officer of the Municipal Electric Lighting & Power Company, of St. Louis, denies that the Thomson-Houston and Fort Wayne Companies have secured a controlling interest in the company. The company proposes to increase its plant by 10,000 incandescent lights and 400 arcs.

The Vandalia has ten of its locomotives equipped with electric headlights, and will at once equip ten more in the same manner. An official of the road says that through the use of this light recently, an accident was doubtless averted which would have been very serious in its character and have cost the company more money than it will to equip every engine on the road with electric lights.

At a meeting of the stockholders of the Jenney Electric Light and Power Company, of Logansport, Ind., the following directors were elected: P. W. Moore, Wm. Douglas, Jos. Seiter, Victor E. Seiter, R. T. McDonald, P. S. Randall and Brainard Rorison. The meeting of the directors which was held immediately afterward resulted in the election of the following officers: President, Jos. Seiter; vice-president, P. W. Moore; secretary, treasurer and manager, Victor E. Seiter.

Alderman Madden, of Chicago, is anxious to have the city's electric light plant extended southward to the World's Fair grounds, so that the streets leading to the fair will be lighted by electricity the entire distance. The city's plant only extends to Twenty-second street. "This ought to be done," said Alderman Madden, "and the money will be found to do it with. The world's fair people ought to be willing to help by diverting to that purpose some of the $5,000,000 of bonds pledged by the city."

POWER.

An electric line from Ironwood, Mich., to Hurley, Wis., is talked of.

North East, Pa., capitalists are considering a project for building a road to Erie.

It is proposed to build an electric railway between Selkirk and Winnepeg, Manitoba.

The city council of Green Bay, Wis., has been asked to grant a franchise for an overhead electric railway.

A Clinton, Ia., paper says that the railway between Clinton and Lyons will be equipped with accumulators.

A Salt Lake City paper states that Horatio S. Conner of that city is making plans for several large power transmission plants at Butte City.

The Lincoln Street Electric Railway Company, whose plant was illustrated in a recent issue of ELECTRICITY, has decided to add to the capacity of its power station and to add new cars to the lines.

The project of extending the Lakewood electric line to the Assembly grounds at Chautauqua next year is in discussion at Jamestown, N. Y. Motor cars, capable of twenty-five miles an hour, are proposed.

The Short Electric Railway Company is making an active canvass in the West. Among its recent contracts for gearless motors is that at Harvey, Ill., one of the suburbs of Chicago. The Harvey Transit Company, composed of some of the capitalists of Chicago, are building this railway.

An elevated electric road of unprecedent height is to be built at Naples. According to the reports that have been received in this country, it is intended to have the supporting pillars over 300 feet in height. The road will connect the central part of the city with the Corso Vittorio Emanuele, and will cost about $1,000,000. The power will be furnished by a waterfall of the Sorrento river.

Petitions and an ordinance will be presented by the Chicago and Jefferson Urban Transit Company at the first meeting of the city council after the summer vacation, for a franchise for an electric railway on the West Side. The route proposed begins on Monroe street at Canal, runs west to Morgan, on Morgan to Fulton, on Fulton to Western avenue, on Western avenue to Grand avenue, and on Grand avenue to Armitage avenue.

A Des Moines paper praises the local street railway company in these terms: "The Des Moines Street Railroad Company has the well earned reputation of owning one of the finest and best equipped electric street railroads in the country. It is operating forty miles of track at present, much of which has recently been rebuilt, and further extensions are constantly being made. It has a full equipment of cars, which are run by the Thomson-Houston overhead wire system. The service is operated by one 1,000 and two 500-horse power engines and ten dynamos."

The Short Electric Railway Company has equipped a special car with its gearless motors. This car is to go into operation for short periods on a number of the most prominent lines in the country, in order to thoroughly familiarize the street railway public with the use of the gearless motor. The car will first be sent to Albany, N. Y., where it will be put into regular service on State street grade, which is one of the longest and most severe grades in the east, averaging about 8 per cent. for a distance of ½ mile, and 5 per cent. or 6 per cent for a much longer distance. This car will probably be sent next to the south or west.

Work on the dam which will be constructed across the Kaw river by the Inter State Water and Electric Power Company, of Kansas City, Kan., will be begun, it is said, within three weeks. The dam has been located and an immense dynamo building and a large equipment building will be erected on land adjacent to the dam on the north side of the Kaw. The whole outlay on construction and equipment will be about $750,000. Secretary Johns is quoted as saying that his company would soon be able to light both Kansas City, Mo., and Kansas City, Kan., at one half present rates and furnish power for street railways, grain elevators, and all kinds of manufacturing and packing establishments at less than half the present cost.

The Pleasant Valley Coal Company, of Salt Lake City, Utah, has for the past year, at the Castle Gate Mine in Utah, used a hoist or haulage drum, operated by electricity. The drum was made by the Lidgerwood Manufacturing Company, of New York, and the electric motor and the electrical equipment furnished by Thomson-Van Depoele Electric Mining Company, Boston, together with all the electric apparatus for the power station. Trains of sixteen large pit cars run out of the mine by gravity, dragging the tail rope after them. The empty trains are hauled back into the mine by the haulage drum located nearly 2,000 feet from the chute in the interior of the mine. The operation of this apparatus has proved so satisfactory and so economical that the company has ordered two more electric hoists of a more powerful type.

JOTTINGS.

An exchange says: "At the present rate of scientific progress, it wont be long before farmers will use electric shocks in their corn fields."

The St. Louis Exposition will be opened this year from to-day until October 17. The management writes that all departments are to be well represented this year. The electrical display will be a notable feature.

The ordinance providing for placing underground all wires used for the transmission of electricity in Milwaukee, for lighting and signals has been signed by Mayor Somers. The date for its enforcement is Jan. 1, 1892.

The "New Island Wanderer," one of the fleet belonging to the Alexandria Bay Steamboat Company, has just been fitted out with a new 20,000 candle power search light and in celebration of the event gave a large excursion on the St. Lawrence a few days ago.

Alfred Speer, the venerable president of the New Jersey Wine Company, at Passaic, has just completed and set in motion a wonderful electrical clock. It stands in his private park. The dial is forty-eight feet in diameter and its minute hand twenty-four feet long. The whole is operated by an ingenious electric motor, which in turn acts in response to a pendulum of a clock in his office. The hands of the clock will be illuminated, which will enable people to tell the time of night five miles away. The chief object of the clock, however, is to regulate the time on railroads or in cities. By means of a wire every clock on a railroad system will show the exact second. In fact, by means of one of these clocks at Washington, every public clock keeping Eastern time could be regulated. Mr. Speer has spent years completing his pet chronometer.

The underground cables for electric lighting in London are put down in an entirely different manner from that which obtains in this country. The mains are laid under the sidewalks wherever it is practicable so to place them, and the covers of the street boxes or manholes (which are really only handholes), are constructed of iron frames filled in with material to suit the paving. During the year ending March 31, 1891, no less than 137½ miles of electric lighting mains were put down in London, besides innumerable subsidiary and special lines to consumers' premises. Of the mains 86½ miles were for high-tension service and 51 miles for low tension. Last year an accident not attended by fatal consequences, happened as a result of the high-tension mains coming in contact with the cover of a street box, the insulation of the cables being defective. To avoid a repetition of these conditions it has been ordered that each of the street boxes shall be provided with an inner as well as an outer cover to be efficiently connected to earth. These measures will render the outer cover entirely harmless, even if the insulation of the cables should become defective.

COMMERCIAL PARAGRAPHS.

W. R. Mason, manager of the Electrical Merchandise Company, returned on Monday from a business trip on which he has been absent several days. He reports present orders and the future outlook good.

The Moore Electrical Manufacturing Co., of 652-660 Hudson Street, New York, has just issued a handsomely illustrated catalogue. It is a book of 96 pages, and is very complete. The book gives a description and illustration of almost every conceivable device that can be classed among general electrical supplies.

The recent action of the Postal Telegraph Company, in making extra compensation to such operators as furnish their own typewriters for the receiving of messages, has resulted in the purchase of many Remington Standard Typewriters. The Remington is a prime favorite with telegraphers, not only because of its small keyboard, but also on account of its excellent wearing qualities.

Godfrey & Pinkham, electrical engineers, Boston, have been compelled to double their staff of employes on account of rapidly increasing business.

A new battery, for which is claimed some extraordinary merits, will be placed on the market in a short time, bearing a very well known Boston name.

A McIntosh-Seymour engine is being installed in its central station by the Middleboro, Mass., Electric Light Company, which has heretofore been operated by water power.

The Gould & Watson Company, whose Lehte insulated electric railway devices have gained such popularity, is running its factory more than full time to keep up with the growing demand.

C. H. Bigelow has gone into business as a contractor for wiring buildings for lights, bells, annunciators, etc., and has installed himself in a comfortable office at 250 Congress street, Boston.

The Great Western Electric Supply Co., Chicago, western agent for K. K. Wire, reports a very good business not only in wire, but other supplies. The Sun arc lamp is having a phenomenal success.

The Hill Clutch Works, of Cleveland, O., have, for a long time, been operating their plant 24 hours per day in order to keep up with their business. They sell largely to electric lighting companies.

The Leach & Grant Company, Franklin street, Boston, makes a specialty of erecting steam and electric plants. The managers of this company have had a wide experience and are well and favorably known.

W. S. Hill, 133 Oliver St., Boston, is enjoying a large trade in high class specialties. His switches and cutouts are in extraordinary demand, many of the principal electrical manufacturing companies in the country using them in large quantities.

In the new Masonic Temple building at Chicago will be installed one of the largest isolated plants in the country and over 65 miles of Simplex wire will be used for the circuits. George Cutter, of Chicago, will supply all the wire used for the lighting circuits.

The Walch Torch Company, of 48 W. Adams st., Chicago, has changed its name to the Gasoline Torch Co., but still remains under the management of J. C. Walch. Through the introduction of new machinery and increased facilities for manufacturing, the company is enabled to reduce greatly the prices of its gasoline blow pipe torches.

The Shauer Molecular Telephone Company, late of Boston, having covered New England pretty thoroughly with subordinate companies to operate its system, has removed its offices to Chicago, where Mr. Whiting, its enterprising manager, will be likely to duplicate the success he has achieved in "the Hub."

A new triple braid, line wire is now manufactured by the Pettingell-Andrews Company, 192-202 Summer street, Boston. This specialty is for overhead lighting circuits, feeder wires for electric railways and for power circuits. It is claimed that the insulation is moisture proof, will never crack or strip, and after long exposure will be found in as good condition as when new.

The International Okonite Company, of 13 Park Row, New York, has just issued its very complete price list, No. 5, of insulated wires and cables for telephone, telegraph, electric light, railway and mining purposes. The price list is the principal thing of interest with those who want okonite wires. Their merits are so well known that no information is necessary on that score.

The Sun Arc Lamp Co., 203 to 207 S. Canal St., Chicago, finds a large and increasing demand for the Sun Arc Lamp. The following, written by one of the customers of the company, speaks well. "I have been using four of your lamps for some time, and they answer my purpose better than any lamp I have ever had, and I have tried most all the prominent ones on the market. You may ship four more as soon as possible."

W. H. Preble, treasurer of the Chicago Rawhide Mfg. Co. of Chicago, reports business good in the different specialties they manufacture for the electrical trade. They have large orders for rawhide pinions and other material used by electric railways. Said Mr. Preble, who is a veteran in the business, "I regret that our company did not commence earlier to protect by patents goods we have placed on the market in the last decade."

The Shultz Belting Company St. Louis and Boston, has just supplied two 24-inch belts to the Lindell street R. R. Co., St. Louis, with orders for more; two belts to Murphyboro, Ill., Electric Light Company; one to the Pond Engineering Company, St. Louis. The Shultz Company is also making a large belt with links ¾-inch thick, for the Catlin Tobacco Company, St. Louis; also one belt 42 inches wide and links one inch thick, for the Missouri Electric Light Company, St. Louis; the latter will be the largest link belt in the world.

The Short Electric Railway Company has closed a large number of contracts for "Gearless" motors for fall delivery. It will commence shipments from the first factory order now nearly completed at its works early in September, and the motors will shortly be running in St. Louis, Mo., Albany, N. Y., Louisville, Ky., Indianapolis, Ind., Washington, D. C., Lincoln, Neb., Rochester, N. Y., Houston, Tex., Harvey, Ill., Cleveland, Ohio, Pittsburg, Pa., Wilkesbarre, Pa., Brooklyn, N. Y. Hot Springs, So. Dakota, etc.

Speaking of the organization of the D. & D. Electrica Manufacturing Company, of Minneapolis, a local paper says: "The growth of the electrical business in general has opened a wide field for the manufacture of electrical apparatus. Companies using light and power are calling for electric motors and dynamos, and the D. & D. (Donaldson & Davis) company will engage in their manufacture in this city, with electric passenger elevators, and all electrical apparatus used in street car work. The capital stock of the company is $50,000."

The Northern Car Company, of Minneapolis, has just completed 20 cars for the Minneapolis Railway Company. One of the local papers has this to say in reference to the cars: "The Minneapolis cars are eighteen feet in length, with internal furnishing of light wood, with two plate glass mirrors at each end and handsomely upholstered. They will be illuminated by the electric lights, and a corresponding globe is placed at the platforms, front and rear. The body is a bright orange in color, while the metal work is black, forming a pleasing contrast with the other finishing and decorative work. The steps are a variation from those found on other cars. They are made of heavy sheets of wire so arranged that all moisture and dirt will readily pass through, insuring a secure foothold at all times. These cars are numbered from 503 to 523. In speaking of the Northern Car Company's very creditable handiwork, a gentleman connected with the street railway remarked: 'They are in every way equal to those turned out by the most successful car companies, and Minneapolis has reason to be proud of an establishment which has shown so much skill.'"

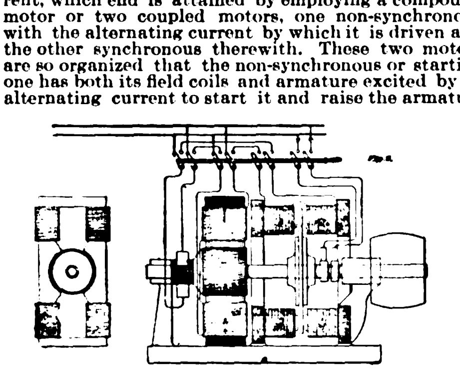
Electric railway companies to-day are no longer satisfied with crude materials. It is everywhere recognized that work must be well done, and that good work pays best in the end. Electric railway companies have by their demands caused the design of lines of electric railway supplies which are in every way suitable for the purpose. They are strong, well designed and cheap. There is great competition in this field, and improvements in the multitudinous railway devices are daily made. The very latest designs in electric railway supplies are shown in catalogue No. 31, of the Electrical Supply Company, of Chicago, which is devoted entirely to electric railway material. Some idea of the magnitude of the demand which construction work makes upon the supply company is shown by a hasty glance at this catalogue of considerably over 200 pages. It is printed throughout in blue. It is well prepared, and the descriptions of the various appliances are clearly and concisely expressed. Catalogues of such a character as this mean more than the simple description and illustration of appliances for the sake of advertising. They are significant of the extensive growth of the electrical interests, and in this particular instance the volume is indicative of the marvelous expansion of the electric railway industry within the last three years. The catalogue will be of value to all those interested in the construction and operation of electric railways.

ELECTRICAL PATENT RECORD.

Letters Patent Issued Aug. 18, 1891.

DYNAMOS AND MOTORS.

457,875. Electro-Motor Engine. Sebastian Ziani De Ferranti, Hempstead, Eng. Application filed Sept. 24, 1888.
The object of this invention is to start an alternating current motor from a state of rest in a simple and effective way by the direct action of an alternating current, which end is attained by employing a compound motor or two coupled motors, one non-synchronous with the alternating current by which it is driven and the other synchronous therewith. These two motors are so organized that the non-synchronous or starting one has both its field coils and armature excited by an alternating current to start it and raise the armature



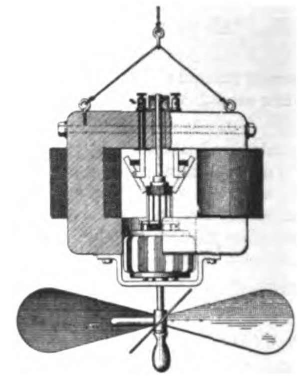
Patent No. 457,875—Electromotor Engine,

of the alternating current machine up to or above the proper synchronizing motor at the same time that the circuit through the non-synchronizing motor is cut out of the alternating main and converted into a closed circuit through the field coils of both the motors. The alternating motor now drives the armature of the non-synchronizing motor, the revolutions of which produce continuous currents, exciting the field coils of both motors, as mentioned. This double function of the non-synchronizing armature makes it possible to dispense with an independent source for generating continuous currents, and of course correspondingly increases the efficiency and simplicity of the apparatus.

457,902. Electric Motor. Charles J. Kintner, New York, N. Y. Application filed Oct. 1, 1890.
This invention is directed particularly to improvements in electric motors for use in connection with ventilating fans which are suspended from the ceiling.

CABLES, CONDUCTORS AND INSULATORS.

457,778. Closed Conduit System for Electrical Propulsion. William B. Heron, Brooklyn, N. Y. Application filed March 27, 1891.
This invention primarily relates to the method of taking the current from the feeder and transferring it to the car or motor mounted thereon, in which is used for this purpose what is termed a "traveling contact or armature," which is caused to travel with the car and through which electrical communication is had between the motor and main feeder. For this purpose a magnet is employed secured to and traveling with the car and located over the conduit and which when properly energized attracts and carries along with it the traveling armature, electrical connection is established



Patent No. 457,902—Electric Motor.

between the feeder, traveling contact or armature, the magnet, and motor.

457,828. Method of Insulating Electric Conductors. Thomas E. Morford, Minneapolis, Minn. Application filed Dec. 26, 1890.
The method stated in a general way, consists in separating the conductor from an object by means of a non-conducting enamel, glaze or film that is made to adhere either to the object or to the conductor.

457,836. Electric Railway Appliance. Frederick E. Degenhardt, Chicago, Ill. Application filed Oct. 13, 1890.
Claim 1 of this invention is "the combination of an electrical conductor with a series of chambers through which it successively passes, said chambers made air tight by a fluid seal and contactors disposed along such conductors and adapted to engage the same within such chambers when depressed, and an exterior contact surface connected with such contactors and adapted to be engaged by a conductor connected with a moving motor.

RAILWAYS AND APPLIANCES.

457,870. Electric Railway System. Milton Shoemaker, Sioux City, Iowa. Application filed Nov. 3, 1890.
This invention provides a means of operating cars by electricity by means of an underground wire completely insulated, without losing power in any way by reason of outside influences.

457,944. Electric Railway System. Samuel E. Wheatley and John W. Schlosser, Washington, D. C. Application filed April 15, 1891.
This invention relates to that system of electric propulsion wherein each car is provided with an electromotor receiving a current through a brush or contact device traveling upon a working conductor which is divided into independent insulated sections, which latter are in turn connected successively through magnetic switches with the main conductor or supply line extending from the generator throughout the length of the road, the arrangement being such that each section of the working conductor is connected with the main conductor only during the time that a car is passing over.

LAMPS AND ACCESSORIES.

457,830. Illuminator for Electric Lamps. John Von Der Kammer, Chicago, Ill. Application filed Jan. 10, 1891.

458,025. Electric Arc Lamps. Elihu Thomson, Swampscott, Mass. Application filed April 27, 1891.
This invention has for its object the securing of a refined and positive feeding motion for the carbons together with the features of compactness and moderate length in the lamp structure itself.

TELEGRAPH.

457,816. Automatic Telegraph. David Kunhardt, Aachen, Germany. Application filed Sept. 23, 1890.

METAL WORKING.

458,115. Method of Electric Bending and Straightening. Elihu Thomson, Lynn, Mass. Application filed May 21, 1886.
The invention consists in passing by suitable clamps a heavy electric current through the section or bar or other piece to be operated upon, so as to bring such section to a working heat irrespective of the other parts not to be forged or otherwise treated, and then bending or straightening by pressing or hammering or the application of force in such a manner as to move the heated particles in the direction required to give the product the intended or desired form or character.

BATTERIES.

457,880. Plate for Secondary Batteries. Albert Franklin Madden, Newark, N. J. Application filed Jan. 2, 1891.

MISCELLANEOUS.

457,838. Electro Stop Mechanism. Washington H. Kilbourne, Greenfield, Mass. Application filed Dec. 24, 1890.

457,855. Railway Signal. Lyman F. Munger, Rochester, N. Y. Application filed Jan. 15, 1891.

457,865. Joint for Electric Conductors. George Thomas Manson, Brooklyn, N. Y. Application filed April 1, 1891.
This invention comprises, broadly, a sleeve of compressible material to surround the conductors at or near the joint, and two rigid tubular clamping devices adapted to be drawn together endwise by means of a screw, the pressure upon the compressible sleeve ceasing. These tubes are drawn together until the sleeve is compressed to a degree at which it will be impossible for moisture to enter.

457,906. Electric Door Opener. Richard J. Ward, Brooklyn, N. Y. Application filed Sept. 15, 1890.

458,063. Electric Wire Crossing. Charles H. McKee, St. Louis Mo. Application filed Jan. 26, 1891.

SUPPLEMENT TO

ELECTRICITY.

SEPTEMBER 2, 1891.

MINIMUM FIRST COST OF PLANT AND MAXIMUM ECONOMY OF OPERATION IN THE ELECTRICAL TRANSMISSION OF POWER.

BY H. WARD LEONARD.

(Copyright.)

A great deal has been, and is being written and said about the condition governing the minimum first cost of a plant for the transmission of power by electricity, and also about the conditions governing the maximum economy of operation of such a plant, and some radical errors and false deductions have been made by those who are considered authorities upon this subject, so that it is not surprising that a somewhat erroneous idea at present exists in the mind of the electrical public upon this question.

As a rule, the theories and deductions developed by the various papers on this subject have given as a conclusion certain formulæ and laws the application of which is practically impossible because of the necessity of using factors, the determination of the value of which is fully as great, if not greater, a problem than that, the solution of which is attempted. The result of this has been that vital errors in some of the most noteworthy papers on this subject have remained unnoticed by most readers, and even if others besides the writer have been familiar with these errors, they have probably felt, as he did, that no good purpose would be served by calling attention to them, as no practical application seemed to have been attempted of these formulæ or laws.

The recent publication, however, of a compilation entitled, "Electric Transmission Hand-Book," by F. B. Badt, makes it appear of importance to call attention to the serious errors contained therein, for Mr. Badt not only publishes all the original errors of the authorities he quotes, but he proceeds to carry the erroneous deductions further and to give and solve practical problems in a manner such that the reader cannot but receive a clear and definite, although entirely incorrect, understanding of the subject. Furthermore, some of the formulæ published by Mr. Badt, and for which the present writer is responsible, have been interpreted by means of erroneous laws laid down by Mr. F. J. Sprague, and consequently an entirely false meaning has been given to formulæ which, when properly interpreted, are entirely correct. In order to point out the errors mentioned in as clear a manner as possible, I shall first treat the subject generally and deduce the correct laws, and then point out the inconsistencies and inaccuracies of the conclusions, formulæ and laws given by Mr. Sprague and Mr. Badt.

Under date of August 16, 1886, the writer published a general formula for the determination of the size of conductors which should supply devices arranged in multiple arc, the form of which was as follows:

$$M = \frac{\text{K. W.} \times D \times 21{,}400}{V(E-V)}; \qquad (1)$$

in which M = Circular millage of conductor.

K. W. = Kilo-watts at terminals of translating device.

D = Distance of transmission in feet.

E = E. M. F. at generator brushes.

V = Volts lost in transmission.

For the sake of explicitness I will indicate the derivation of the formulæ.

Res. of 1 foot cir. mil of commercial copper .... = 10.7 ohms.

Res. of 2 D feet of conductor of 1 cir. mil .... = 21.4 D

Res. of 2 D feet of conductor of M cir. mil .... = $\frac{21.4\ D}{M}$

$$M = \frac{21.4\ D.}{R} \quad \text{Now } R = \frac{V}{C} = \frac{V}{\frac{1{,}000\ \text{K.W.}}{E-V}} = \frac{V(E-V)}{1{,}000\ \text{K.W}}$$

$$\therefore\ M = \frac{21.4\ D \times 1{,}000\ \text{K. W.}}{V(E-V)} = \frac{\text{K. W.} \times D \times 21{,}400}{V(E-V)} \qquad (1)$$

Weight of 1 ft. cir. mil of copper = .000003027 lb.

∴ Calling T the weight of conductor in lbs. and allowing 3 per cent. for sag, etc.

$$T = \frac{D^2 \times \text{K. W.}}{V(E-V) \times 7.5} \qquad (2)$$

Calling B the cost of conductor in dollars, we have, with copper at L cents per lb.

$$B = \frac{D^2 \times \text{K. W.} \times L}{750\ V(E-V)} \qquad (3)$$

∴ The cost of the conductor per K. W. at motor brushes is:

$$\frac{B}{\text{K. W.}} = \frac{D^2 L}{750\ V(E-V)} \qquad (4)$$

Calling G, the cost of dynamo electric machinery per K. W. at brushes and $\frac{A}{\text{K. W.}}$, the cost of generator per K. W at motor brushes, we have

$$\frac{A}{\text{K. W.}} = \frac{100\ G}{100-P} \qquad (5)$$

where P = the percentage of loss in the conductor; this may also be expressed as follows:

Cost of generator per K. W. at motor brushes,

$$\frac{A}{\text{K. W.}} = \frac{G\ E}{E-V} \qquad (6)$$

The cost of the generator and of the bare copper for the conductor are the only two elements of the cost of a power transmission plant which it is necessary to consider in the determination of the condition of Minimum First Cost of Plant, for the other factors of the cost of the plant, such as the development of the motive power, the labor of erecting the line, etc., are not proportionate to the power delivered, and hence should not be considered in the determination of the minimum conditions.

With any given initial E. M. F. and distance, it is evident that the more volts we lose in the transmission, the less will be the cost of the conductor; but at the same time the cost of the generator per unit of power transmitted will be increased because of the additional generator capacity required to take care of the increased amount of energy lost in the conductors.

Hence it is evident that for any given initial E. M. F. and distance there must be some particular loss in the conductor which will make the combined cost of the generator and conductor a minimum. We can determine the minimum value by placing the first differential of the expression indicating the sum of the costs of the generator and the conductor equal to zero.

From (4) and (6) we have, cost of generator plus cost of conductor

$$= \frac{A+B}{\text{K. W.}} = \frac{G\ E}{E-V} + \frac{D^2\ L}{750\ E\ (E-V)} \qquad (7)$$

Placing the first differential = 0 we have:

$$\frac{G\ E}{(E-V)^2} - \frac{750\ D^2\ L\ (E-2\ V)}{750^2\ V^2\ (E-V)} = 0. \qquad (8)$$

From which we get,

$$D^2 = \frac{750\ G\ E\ V^2}{L\ (E-2\ V)} \qquad (9)$$

This last equation expresses the relation existing under the conditions of Minimum First Cost of generator and conductor, and consequently of the entire plant.

$$\text{Since} \quad \frac{E}{E-2\ V} = \frac{100}{100-2\ P} \qquad (10)$$

we have from (9) and (10)

$$D^2 = \frac{75{,}000\ G\ V^2}{L\ (100-2\ P)} \qquad (11)$$

Calling $\frac{B_m}{\text{K. W.}}$, the cost of conductor in dollars per K. W. at motor brushes under conditions of minimum first cost of plant, we have from (4) and (11)

$$\frac{B_m}{\text{K. W.}} = \frac{G\ E\ V}{(E-V)\ (E-2\ V)} \qquad (12)$$

$$\text{and} = \frac{100\ G\ P}{(100-P)\ (100-2\ P)} \qquad (13)$$

Calling $\frac{A_m}{\text{K. W.}}$ the cost of generator in dollars per K. W. at motor brushes under conditions of minimum first cost of plant, we have from (6) and (9)

$$\frac{A_m}{\text{K. W.}} = \frac{D^2\ L\ (E-2\ V)}{750\ V^2\ (E-V)} \text{ and} \qquad (14)$$

$$= \frac{D^2\ L\ (100-2\ P)}{750\ V^2\ (100-P)}. \qquad (15)$$

When the cost of dynamo is \$33 per K. W. at brushes and copper is 20 cents per lb., that is, when $G = 33$ and $L = 20$, we have, from (11),

$$D^2 = \frac{123{,}750\ V^2}{100-2\ P} \qquad (16)$$

$$\text{From (3) we have } D^2 = \frac{\frac{B_m}{\text{K. W.}} \times 750\ V\ (E-V)}{L} \qquad (17)$$

With any fixed initial E. M. F. and a certain percentage of loss, we can get by (13) the value of $\frac{B_m}{\text{K. W.}}$, the cost of the conductor under conditions of minimum cost; and knowing the cost of the conductor, we can by (17) get the value of D. Thus for any initial voltage and percentage of loss we can determine the cost of conductor and the distance of transmission which corresponds to the minimum first cost of plant. By determining such values at 10, 12½, 15, 20, 25, 30 and 40 per cent., we are able to plot the lines of minimum first cost as given by the accompanying CHART 1.

By the use of CHART 1 we can quickly determine the percentage of loss necessary for any initial E. M. F. and distance in order that the cost of plant shall be minimum; and we also learn at the same time the corresponding cost of the generator and of the conductor.

Thus, if we have an initial E. M. F. of 3,000 volts and a distance of 50,000 feet we must, in order to secure the minimum first cost of plant, operate with a loss of 30 per cent., and in such case the cost of generator = \$47.15, and cost of conductor = \$35.35 per K. W. at motor brushes; so that adding the cost of motor, \$33 per K. W., we have total cost of generator, conductor and motor = \$115.50. (*Example* 1.)

Similarly, if we have a distance of 30,000 feet and 3,300 volts initial E. M. F. we must operate at 20 per cent. loss, and the total cost of the generator, conductor and motor will be \$88.00. (*Example* 2.)

Now, it by no means follows, because we are working with the minimum first cost of plant for a certain voltage and distance, that we are working at the highest economy, for, evidently, it is possible that if we work with a less percentage of loss in the case cited in Example 1, although our investment be increased thereby, the interest and depreciation on this increase of investment may be much less than the saving we would effect, due to the reduction of the loss of energy in the conductors. In other words, we must consider the variation in the interest and depreciation upon the investment, as well as the variation in the value of the energy wasted in the conductors, and must make the sum of the interest and depreciation on investments plus the value of the energy wasted in the conductor, a minimum, in order to operate at the maximum economy.

The interest on the investment can be definitely determined, but the value of the energy wasted it is very difficult to determine before the installation is made, for the reason that it is usually impossible to ascertain exactly how much of our total power will be transmitted in the future, as this is usually dependent upon an unknown demand. In addition to this, the value per K. W. of the power wasted will frequently be almost noth-

ing in the beginning, when a large water power is available and there is a demand for but a small portion of it, but later the value per K. W. of the energy wasted would probably be much greater.

Thus, while we can determine with absolute accuracy the Minimum First Cost, the question of the Most Economical First Cost is a question almost entirely for the investor to decide. We should be able to tell him not only the minimum first cost and its corresponding percentage of loss, but also the cost corresponding to any other loss than that demanded for the minimum cost.

In order to accomplish this I have designed CHART 2, which gives not only the cost of plant and necessary percentage of loss for any case, of initial E. M. F. and distance under the conditions of Minimum First Cost, but it also gives the cost of plant for the given initial E. M. F. and distance with any other percentage of loss.

Thus if, as in Example 1, the distance is 50,000 feet and the initial E. M. F. 3,000 volts, we find, by examining the curve in which the initial E. M. F. equals 60 volts per 1,000 feet, that the minimum first cost of plant will be realized when we operate at 30 per cent. loss, and that the corresponding cost of generator and conductor is $82.50, making the total cost of the generator, conductor and motor $115.50.

We also learn that if, with the same initial E. M. F. and distance, we operate at various losses, the cost of generator and conductor varies as follows:

30 per cent. loss	....	$82.50
25 " "	....	83.20
20 " "	....	87.20
15 " "	....	90.60
10 " "	....	119.00

If now, we have a superabundance of water power and are transmitting but a small fraction of it and the value of the energy wasted is consequently negligible, we would do better to operate at 30 per cent. loss and reduce our investment to a minimum. But if our power be limited and valuable so that the value of the energy wasted becomes an important consideration, we must then, for the highest economy, operate at such a loss in conductors that, although the cost of plant may not be a minimum, the sum of the interest and depreciation on such cost, plus the value of the energy wasted, will be a minimum.

It will be evident that when such sum is a minimum we will be operating at the highest economy. To determine this minimum let us call I the rate of interest and depreciation on the investment, expressing I in per cent. Let U be the value of 1 K. W. at the brushes of the motor, used as it will be used in practice. Then from (7) we have

Interest and depreciation on capital invested in generator and conductor per K. W. at motor brushes

$$= \frac{I}{100}\left(\frac{G\,E}{E-V} + \frac{D^2\,L}{750\,V(E-V)}\right) \quad (18)$$

The value per K. W. at motor brushes of the energy wasted in the conductor per annum will be

$$\frac{V\,U}{E-V} \quad (19)$$

The sum of (18) + (19) is that portion of the cost of operating subject to variation by a variation in the loss in the line, and to learn when this is a minimum we will place the first differential of

$$(18) + (19) = 0.$$

Doing this, we find that the equation expressing the condition of Minimum Operating Expenses, or, in other words, Maximum Economy of Operation, is

$$D^2 = \frac{750\;E\;V^2\;(I\,G + 100\;U)}{L\;I\;(E-2\,V)} \quad (20)$$

From this, calling B_e the cost of conductor under conditions of maximum economy, we find

$$B_e = \frac{E\;V\,(I\,G + 100\;U)}{I\;(E-V)\;(E-2\,V)} \quad (21)$$

and calling A_e the cost of generator under conditions of maximum economy, we find,

$$A_e = \frac{D^2\,L\,(E-2\,V)}{750\;V^2\;(E-V)} - \frac{100\;E\;U}{I\;(E-V)} \quad (22)$$

From this relation we can plot curves which will enable us to quickly determine the conditions of maximum economy in practice. A set of such curves is shown in CHART 3.

CHART 3 is designed for transmissions in which 100 volts are allowed per 1,000 feet of transmission. Two sets of curves are plotted, one, marked X, assuming the combined interest and depreciation to be 10 per cent. per annum, and the other set assuming 15 per cent. for these items.

The value of the energy wasted is also plotted when the value of the energy is $5, $10, and $20 respectively, per kilo-watt at motor brushes; and then each of these latter curves is combined with each of the former, giving as a result the operating cost under six different conditions and indicating the maximum economy in each case, and also the variation in the expense due to any deviation from the loss corresponding to the maximum economy.

Example 3. For instance, suppose a transmission of 30,000 feet with 3,000 volts initial E. M. F., and suppose we value interest and depreciation at 15 per cent. per annum. Also, suppose our power to have a value at first of $5 per K. W. at generator brushes. By CHARTS 2 and 3 we find that the maximum economy will be realized when we operate at 17 per cent. loss, although the minimum first cost of plant alone would be realized when we operate at 21.47 per cent.

If later on in this same plant the increasing scarcity of power makes its value $20, instead of $5, per K. W. we find that we must arrange our plant as we increase it, so that the loss shall be 11½ per cent. since by CHART 3 we find we will then be operating at the maximum economy.

It will be seen that by the use of these formulæ and their resultant curves any problem in the transmission of power can be readily and accurately determined. The value of these curves will be evident, when attention is called to the fact that there is in use in this country a plant put in by one of the leading companies, in which the equivalent of the following conditions prevail: Initial E. M. F. 2,200 volts; distance 50,000 feet; loss in conductor 50 per cent. The company who installed this plant even now consider it satisfactory; yet we see from CHART 2, by examining the curve of 44 volts per 1,000 feet, that with exactly the same cost of generator and conductor they could have operated at 22 per cent. loss instead of 50 per cent., making a net gain in the power delivered of 56 per cent., or they might have made a saving in their investment of $10 per kilo-watt delivered by conductor with an increase in power of 30 per cent., had they worked at 35 per cent. loss in conductor, which is that required for minimum first cost.

The following examples will serve to give a clear idea of the use of these curves:

Example 4. Suppose a proposed transmission of 30,000 feet, and that 6,000 volts is the highest voltage we have dynamos for; that is, 200 volts per 1,000 feet. By CHART 1 we learn that for

CHART No. 1.

TRANSMISSION OF POWER.

BY H. WARD LEONARD.

(*Copyright.*)

Showing Minimum First Cost of Plant, under Varying Distances and Initial E. M. F.'s.

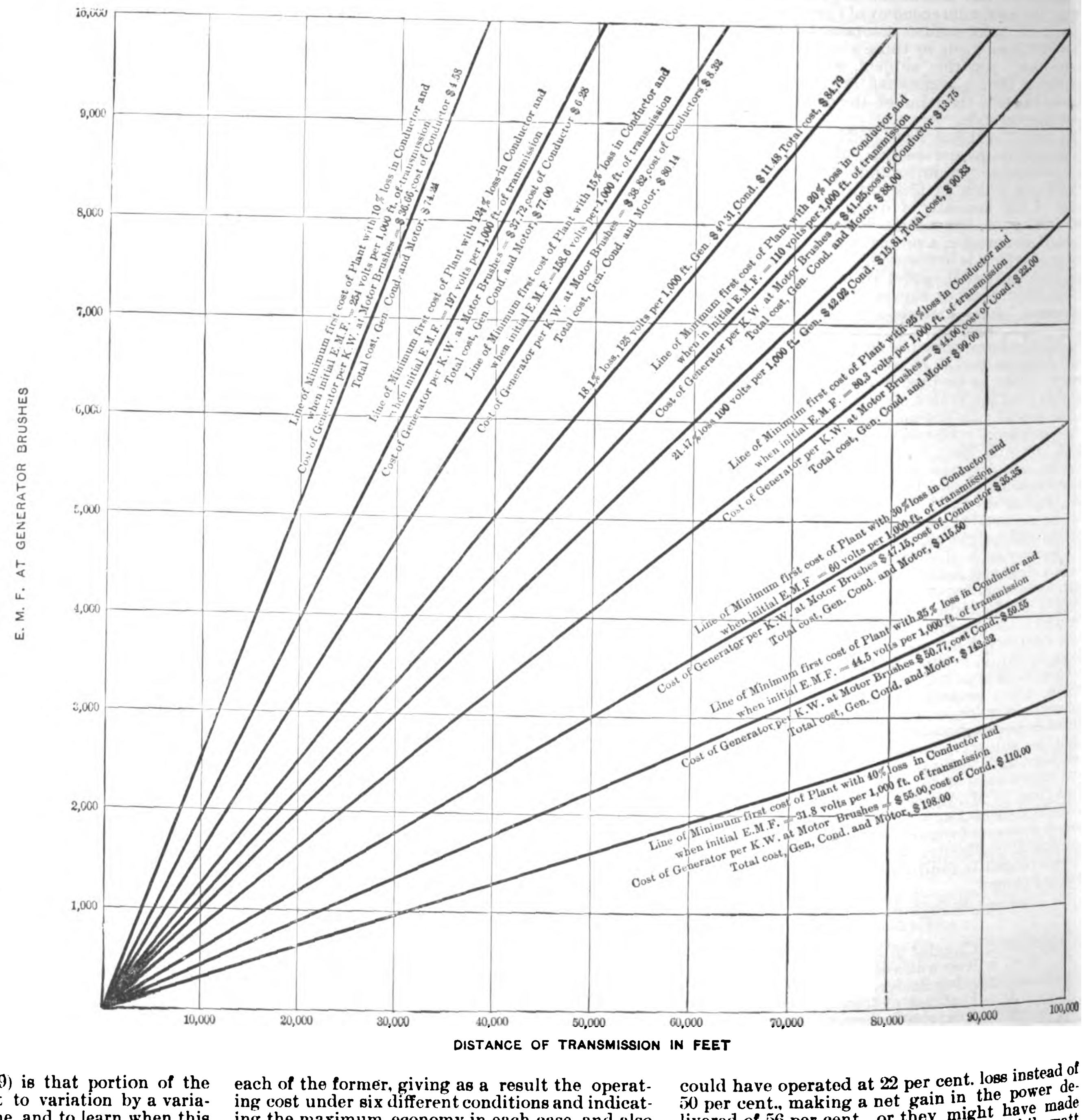
D = Distance of transmission in feet.
E = Initial E. M. F.
V = Volts lost in transmission.
G = Cost of dynamos per *K. W.* at brushes.
L = Cost of bare copper in cents, per lb.
$\frac{A_M}{K.W.}$ = Cost of generator per *K. W.* at motor brushes under conditions of minimum first cost.
$\frac{B_M}{K.W.}$ = Cost of conductor per *K. W.* at motor brushes under conditions of minimum first cost.

Under conditions of minimum first cost of plant and when G = $33.00 and L = 20 cents,

$$D^2 = \frac{123{,}750\;V^2}{100 - 2\,P}$$

$$\frac{A_M}{K.\,W.} = \frac{D^2\;L\;(E-2\,V)}{750\;V^2\;(E-V)} = \frac{D^2\;L\,(100-2\,P)}{750\;V^2\;(100-P)}$$

$$\frac{B_M}{K.\,W.} = \frac{G\;E\;V}{(E-V)\;(E-2\,V)} = \frac{100\;G\;P}{(100-P)\,(100-2\,P)}$$



minimum first cost we must lose 12½ per cent. in conductor, that the cost of bare copper conductor will be $6.28 per K. W., that of the generator $37.72; total cost of generator, conductor and motor $77.

Example 5. If we have but 3,000 volts available for the initial E. M. F., we must for the minimum first cost lose 21½ per cent. The cost of conductor will be $15.81, that of generator, $42.02; and that of generator, conductor and motor $90.83.

Example 6. If, instead of 12½ per cent. loss, we wish to lose less, we find from CHART 2 that the cost of such generator and conductor will be as follows: 6,000 volts and 5 per cent., $50; 6,000 volts 10 per cent., $43.25. Knowing the value of the power and the rate of interest and depreciation, we can determine which loss to operate at. It will be noticed that with 6,000 volts, we should, under no circumstances, lose more than 12½ per cent. in the conductor, as with greater losses not only the waste of energy increases, but also the cost of plant.

There are four factors in a transmission plant—the distance, the initial E. M. F., the percentage of loss, and the cost of plant, and knowing any three we can by CHART 2 get the fourth. We have already considered the case of fixed distance, initial E. M. F. and per cent. of loss.

Suppose now, distance, loss and cost be fixed and we want to determine initial E. M. F. necessary.

Example 7. Suppose the distance as before 30,000 feet, and that the loss must not exceed 20 per cent., and that the cost of generator and conductor must be $55 per K. W. invested in the best possible way. By CHART 2 we find that with 110 volts per 1,000 feet, that is, 3,300 volts initial E. M. F., our loss will be exactly 20 per cent. and the cost exactly $55. Also, that with 7,620 volts initial we need only lose 10 per cent., and still the cost will be only $41; and by using 3,750 volts and 11 per cent. the cost will still be but $55; also by using 6,000 volts initial and 3½ per cent. loss the cost would be only $55.

The next case will be where distance, initial E. M. F. and capital to be invested are fixed, and we wish to determine the percentage of loss necessary.

Example 8. Suppose distance 30,000 feet; initial E. M. F., 1,800 volts; capital to be invested, $100 per K. W. for generator and conductor. Having 60 volts per 1,000 feet available, we find that we must operate at 14 per cent. loss.

Now, suppose investment, initial volts and permissible loss to be fixed, and we want to find the maximum possible distance of transmission.

Example 9. Suppose investment, in generator and conductor fixed at $60; initial volts, 2,400; percentage of loss, 15 per cent. We find that the maximum distance corresponding is 24,000 feet.

Let us now briefly examine the formulæ and laws which have been referred to by Mr. Badt in his "Electric Transmission Hand-Book." Mr. Badt quotes freely from a paper by Mr. F. J Sprague, read before the Franklin Institute, which was printed in the *Journal* of the Franklin Institute for April, 1889. By careful examination of the paper it will be found that, after having assumed the value of the E. M. F. at the motor brushes and the distance also being fixed, the error is made afterward of considering the results obtained as applicable to cases in which these values are variable. Hence it is not surprising that we find Mr. Sprague saying: "That is with fixed conditions of cost and efficiency of apparatus the number of volts fall, to get the minimum cost, is a function of the distance alone and is independent of the E. M. F. at the motor, a somewhat startling conclusion."

In the light of what we have already seen it will be evident that this statement is entirely incorrect. To make this more clear (*Example* 10) suppose that with the same distance as in *Example* 1, that is, 50,000 feet, and the same efficiency of apparatus, that is 30 per cent. loss in conductor, we use the initial E. M. F. of 6,000 instead of 3,000, and consequently have an E. M. F. at the motor of 4,200 volts, instead of 2 100 volts, as before. Now, according to Mr. Sprague, the "minimum cost of plant is a function of the distance alone and is independent of the E. M. F. used at the motor;" yet it will be evident that in "*Example* 10" the cost of the conductor is only ¼ of that in *Example* 1 and the cost of the generator is the same; hence the total cost is much reduced. In other words, while, if we fix the initial E. M. F. and distance, there is a definite loss in conductor at which we must operate in order to have a minimum first cost of plant, it by no means follows that if we fix the distance and percentage of loss there is a definite initial E. M. F. which corresponds to a minimum first cost of plant; for evidently, the higher we make the initial E. M. F., meantime keeping the percentage of loss constant, the more we reduce the cost of plant, and there is no minimum value under these conditions.

Following out the same error, Mr. Sprague also lays down the following incorrect law: "With any fixed couple and commercial efficiency the cost of the wire should bear a definite and fixed ratio to the cost of the generating plant." It will be evident from what we have just seen regarding the preceding law, that this one is equally as incorrect and formulæ (13) and (15) clearly indicate the impossibility of either of them being correct. In his paper Mr. Sprague gives several tables based upon these laws, and since this same error is maintained throughout his results are entirely incorrect.

Mr. Badt has not only followed Mr. Sprague blindly, but has gone much farther and has finally brought up with such remarkable results, that we find him, after stating some of these surprising conclusions, saying: "At the same time it seems somewhat startling that for the minimum cost of the installation under given conditions as mentioned before (*i. e.*, fixed cost and efficiency of

CHART No. 2.

TRANSMISSION OF POWER.

BY H. WARD LEONARD.

Showing Minimum First Cost of Plant for any Distance and Initial E. M. F., *with Corresponding Necessary Loss in Conductor, and also Showing Variation in Such Cost Occasioned by Losses other than those Necessary for Minimum First Cost.*

D = Distance of transmission in feet.
E = Initial E. M. F.
V = Volts lost in transmission.
G = Cost of dynamos per $K. W.$ at brushes.
L = Cost of bare copper in cents, per lb.
$\frac{A_M}{K.W.}$ = Cost of generator per $K. W.$ at motor brushes under conditions of minimum first cost.
$\frac{B_M}{K.W.}$ = Cost of conductor per $K. W.$ at motor brushes under conditions of minimum first cost.

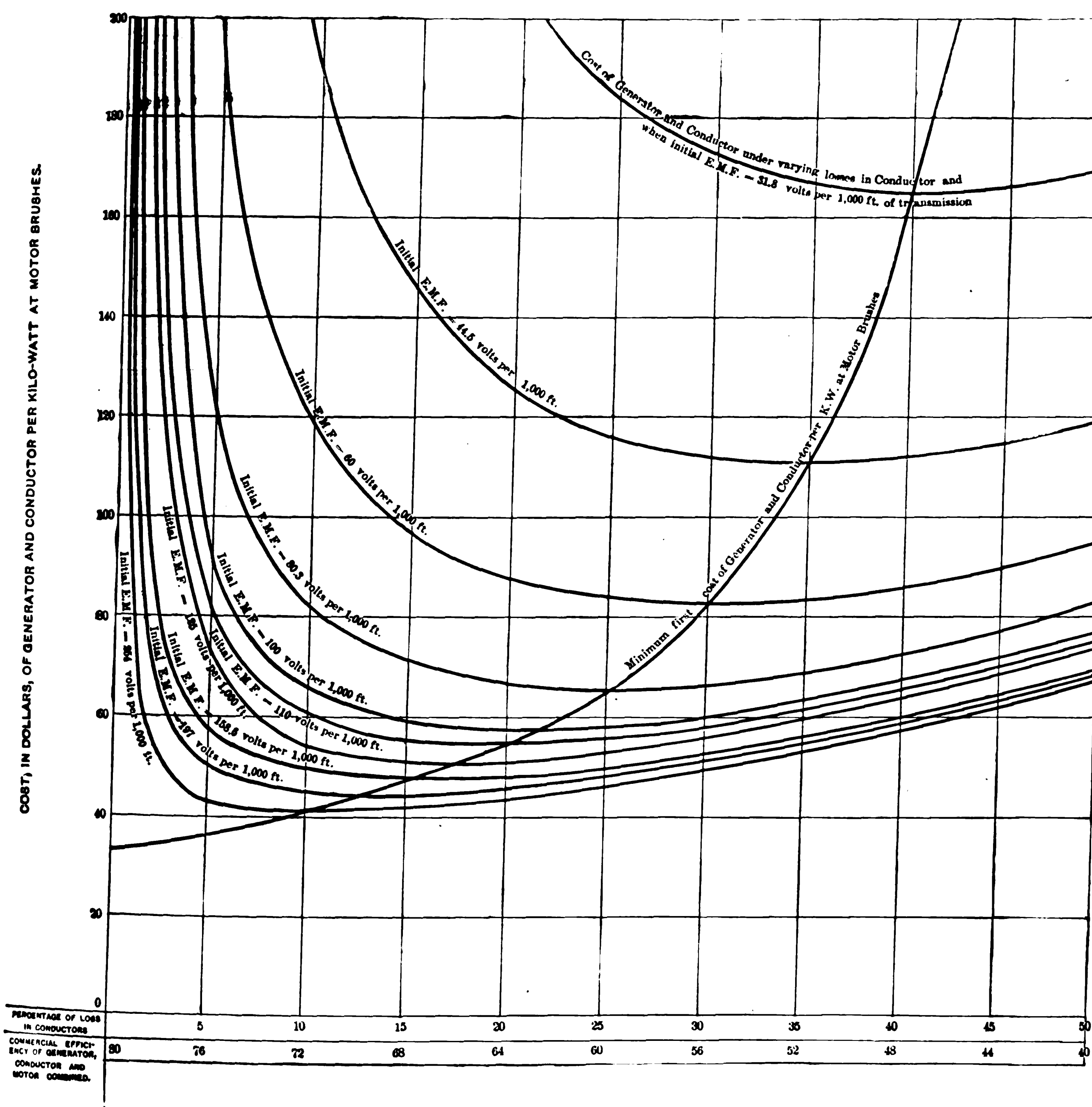
Cost (in dollars) of bare copper conductor per $K. W.$ at motor brushes (general case) $= \frac{D^2 L}{750\, V\, (E - V)}$.

Under conditions of minimum first cost of plant and when $G = \$33.00$ and $L = 20$ cents,

$$D^2 = \frac{123{,}750\, V^2}{100 - 2P}.$$

$$\frac{A_M}{K.\,W.} = \frac{D^2 L\,(E - 2V)}{750\, V^2\,(E - V)} = \frac{D^2 L\,(100 - 2P)}{750\, V^2\,(100 - P)}.$$

$$\frac{B_M}{K.\,W.} = \frac{G\,E\,V}{(E - V)\,(E - 2V)} = \frac{100\,G\,P}{(100 - P)\,(100 - 2P)}.$$



apparatus), the volts lost in the conductor are dependent upon the distance alone."

It seems almost impossible that such a statement as this could be seriously made by an electrical engineer of practical experience, yet we find Mr. Badt giving examples and tables in which it is surprising that he did not see the absurdity of this statement. For instance, on page 28 he gives "*Example* 1. Distance, including 5 per cent. for sag, 7,000 feet; E. M. F. at motor terminals, 500 volts. What must be the loss in the wire and E. M. F. of generator for minimum cost of plant?"

Mr. Badt, by the aid of Mr. Sprague's laws, with his own additions, concludes that he must have 20 per cent. loss in conductor; hence 625 volts at the generator. Since the E. M. F. at the motor is fixed, is it not evident that the higher the initial E. M. F. and the less the percentage of loss in the line, the less will be the cost of plant? In other words, if the cost be a certain amount at 20 per cent. loss in conductor with 625 volts initial, would it not be less with 10,000 volts initial and 1,000 volts loss in conductor or 10 per cent.?

Similarly, "*Example* 2. Distance (including 5 per cent. for sag) 50,000 feet; we want to obtain at least 55 per cent. efficiency (from generating pulley to motor shaft). What is the voltage to be employed at motor and generator for minimum cost of plant?"

Mr. Badt finds that the E. M. F. generated must be 2,741 and that of the motor 1,850, with a loss in conductor of 32.5 per cent. Is it not evident that by using 5,482 volts at generator and 3,700 at motor the cost of generator is the same and the cost of conductor only ¼ what it was, and that there is no limit to the possible reduction in cost of the conductor, and hence no minimum value?

Mr. Badt, following the law that, "the number of volts to get the minimum cost of plant is a function of the distance alone," finds that for every 1,000 feet we must lose 17.5 volts, and with fixed cost and efficiency of apparatus no other factors need be considered. This, certainly has the beauty of simplicity, and the tables built upon this conclusion leave little to be desired in that direction; but the transmitter of power who follows these tables will pay heavily for his faith in them.

Another law which Mr. Badt deduces, after making the assumption that "$\frac{D}{V}$, the relation of distance to volts drop for a minimum cost of plant, is a constant," appears on page 37, and is as follows: "For minimum cost of plant the total weight of the conductor per horse power delivered by the motor shaft remains the same at a certain percentage of loss in the conductor, regardless of the voltage of motor and the distance." This involves the same erroneous assumptions and is evidently absurd, as is another law on page 39: "For minimum cost of plant the weight of the conductor depends only on the percentage of loss in the conductor and the number of mechanical horse power delivered by the motor."

Mr. Badt, on page 42, quotes from Mr. Sprague another equally misleading rule, viz.: "For minimum initial cost of plant, and assuming certain prices per horse power of motors, generators and power plants (all erected and ready for operation), and assuming a certain price per pound of copper (delivered at the poles), the total cost of plant, excluding line construction, is a constant for a certain efficiency of the electric system, no matter what the E. M. F. of the motor and the distance may be." The absurdity of this is evident from what we have seen and is clearly shown by CHART 2.

We now come to a consideration of the conditions governing the maximum economy of operation.

Sir William Thomson, in a paper entitled "The Economy of Metal Conductors of Electricity," read before the British Association in 1881, stated the following law: "The most economical area of conductor will be that for which the annual interest on capital equals the annual cost of energy wasted."

This law has been accepted ever since that date with slight modifications, but upon close and practical investigation it proves to be entirely incorrect as applied to maximum economy of operation of a plant, for the very surprising reason that no account whatever is taken of the fact that the cost of the generator per horse power transmitted will vary as the loss in the line varies.

Since the variation in the cost of the generator is the principal factor, it is not surprising that the correct minimum and that obtained from Thomson's law are widely different. In fact, it will frequently be impossible to apply Thomson's law, as it will frequently occur that the interest on the plant, even when at its minimum cost, will far exceed the value of the energy wasted; and, evidently, if we depart from the condition of minimum first cost with an endeavor to increase the loss and thereby to make the value of the increasing loss in the line finally equal the interest on the increased cost of plant, since we are increasing both items, we evidently are not approaching a minimum value. CHART 3 clearly shows that, frequently, the curve of interest and depreciation and the curve of value of energy wasted will never cross, and hence will never be equal under any conditions of loss.

Formulæ (21) and (22) clearly show that no such relation can exist, and CHART 3 makes it evident graphically. *Example 11.* We find that by Sir William Thomson's law if the power is worth $20 per K. W. at generator brushes, and the interest and depreciation is 10 per cent., we should work at 22½ per cent. loss; whereas, in reality, for the maximum economy we should work at 10 per cent.

We also find that in all the seven other cases indicated by the curves it is impossible to apply Thomson's law, as we cannot, by any means, make the interest on capital outlay and the value of energy wasted equal.

Both Kapp and Ayrton and Perry have discussed Thomson's law and made certain limitations and modifications, but have only complicated, and not corrected it. In Mr. Badt's present work he refers to Kapp's latest formulæ contained in a lecture of March 2, 1891, a copy of which lecture I have not as yet seen; hence the formulæ quoted by Mr. Badt cannot be commented on by me further than that Mr. Kapp's formulæ as given by Mr. Badt point to one fact which is very evident from formulæ (13) and (21), CHART 1, namely, that under no circumstances will it be economical to lose more than 50 per cent. in the conductor, for when $E = 2V$, we have $E - 2V = 0$, and an infinite cost of conductor as a resulting condition.

CHART No. 3.

TRANSMISSION OF POWER.

BY H. WARD LEONARD.

(*Copyright.*)

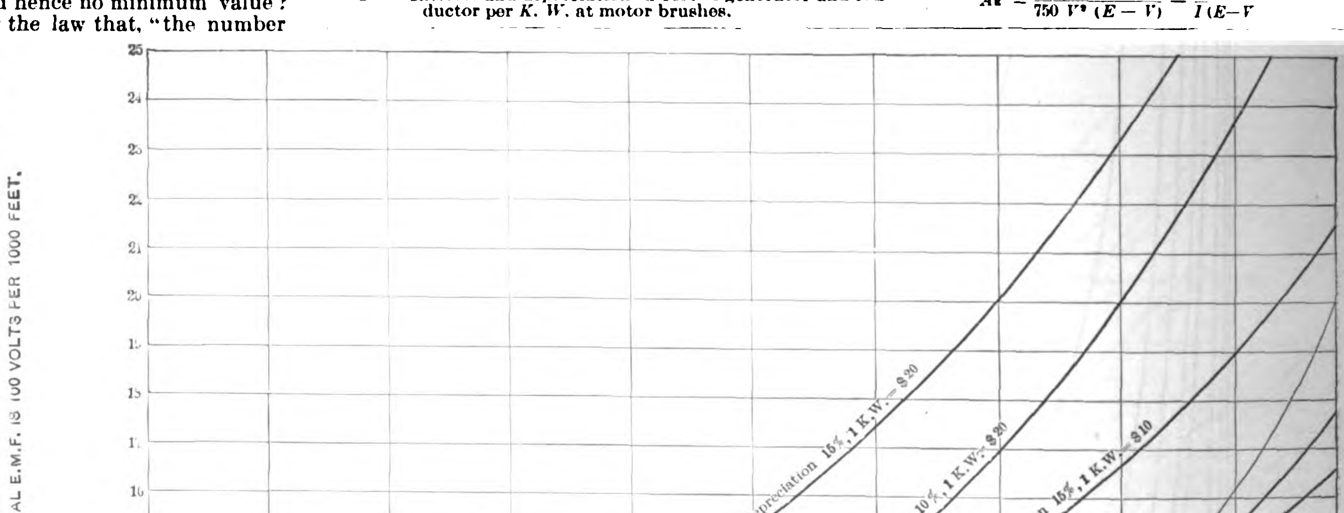
Showing Maximum Economy of Operation when 100 Volts per 1,000 Feet are Used, and when Interest and Depreciation on Plant is 10 per cent. and 15 per cent., and when Value of Power at Generator Brushes is $5.00, $10.00, and $20.00 per K. W. respectively.

A_x = Cost of generator per *K. W.* at motor brushes under conditions of maximum economy of operation.
B_x = Cost of conductor per *K. W.* at motor brushes under conditions of maximum economy of operation.
L = Cost of bare copper in cents per lb.
D = Distance of transmission in feet.
E = Initial E. M. F.
V = Volts lost in transmission.
G = Cost dynamo per *K. W.* at brushes.
I = Interest and depreciation on cost of generator and conductor per *K. W.* at motor brushes.
U = Value of 1 *K. W.* per annum at brushes of motor as used.

$$D^2 = \frac{750\,E\,V^2\,(I\,G + 100\,U)}{L\,I\,(E - 2\,V)}$$

$$B_x = \frac{E\,V\,(I\,G + 100\,U)}{I\,(E-V)\,(E-2V)}$$

$$A_x = \frac{D^2\,L\,(E - 2V)}{750\,V^2\,(E - V)} - \frac{100\,E\,U}{I\,(E-V}$$



ELECTRICITY.

VOL. I. CHICAGO. SEPTEMBER 9, 1891. NEW YORK. No. 8.

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ELECTRICITY.

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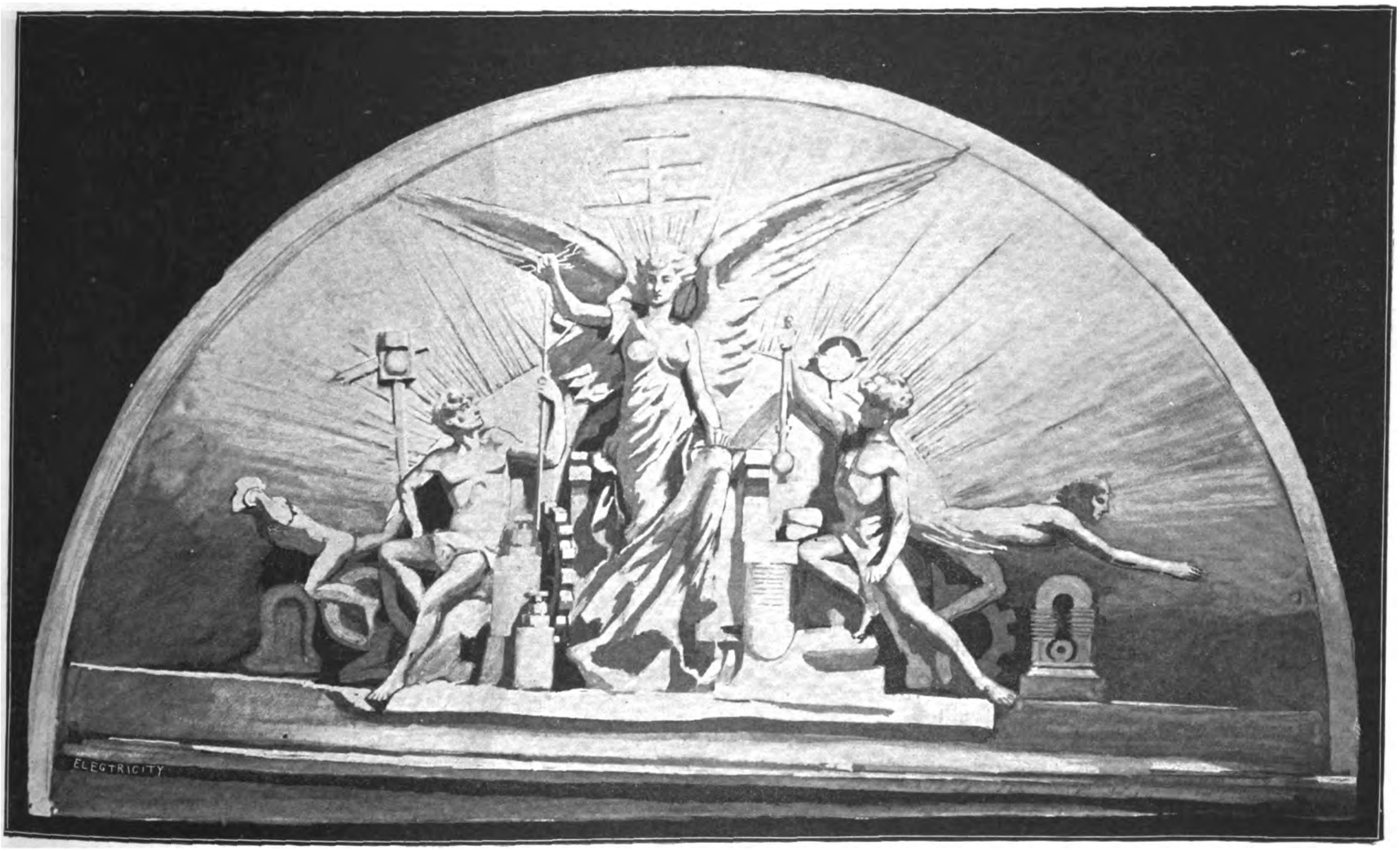


DECORATIONS FOR THE WORLD'S FAIR ELECTRICITY BUILDING.

(See page 88.)

DECORATIONS FOR THE WORLD'S FAIR ELECTRICITY BUILDING.

In this issue considerable space is devoted to the decorations now being prepared for the Electricity building at the Columbian Exposition. The illustrations are made from photographs of the unfinished designs. All the designs were furnished by the World's Fair commission and the work was executed by the Phillipson Decorative Company, of Chicago, under the superintendence of Manager Leopold Bonet. The frontispiece, an allegorical design, represents the "Goddess of Electricity" in the center, grasping in her right hand the thunderbolt which is rendered harmless by the lightning rod in the hands of the figure at her right.

To the left, another figure holds aloft an arc light symbolical of illumination. To the extreme right the telephonic message is speeding on its way to the recipient, represented by a figure holding to his ear the receiving instrument. The attitudes of both figures are indicative of the speed which is appropriate to the instruments they symbolize.

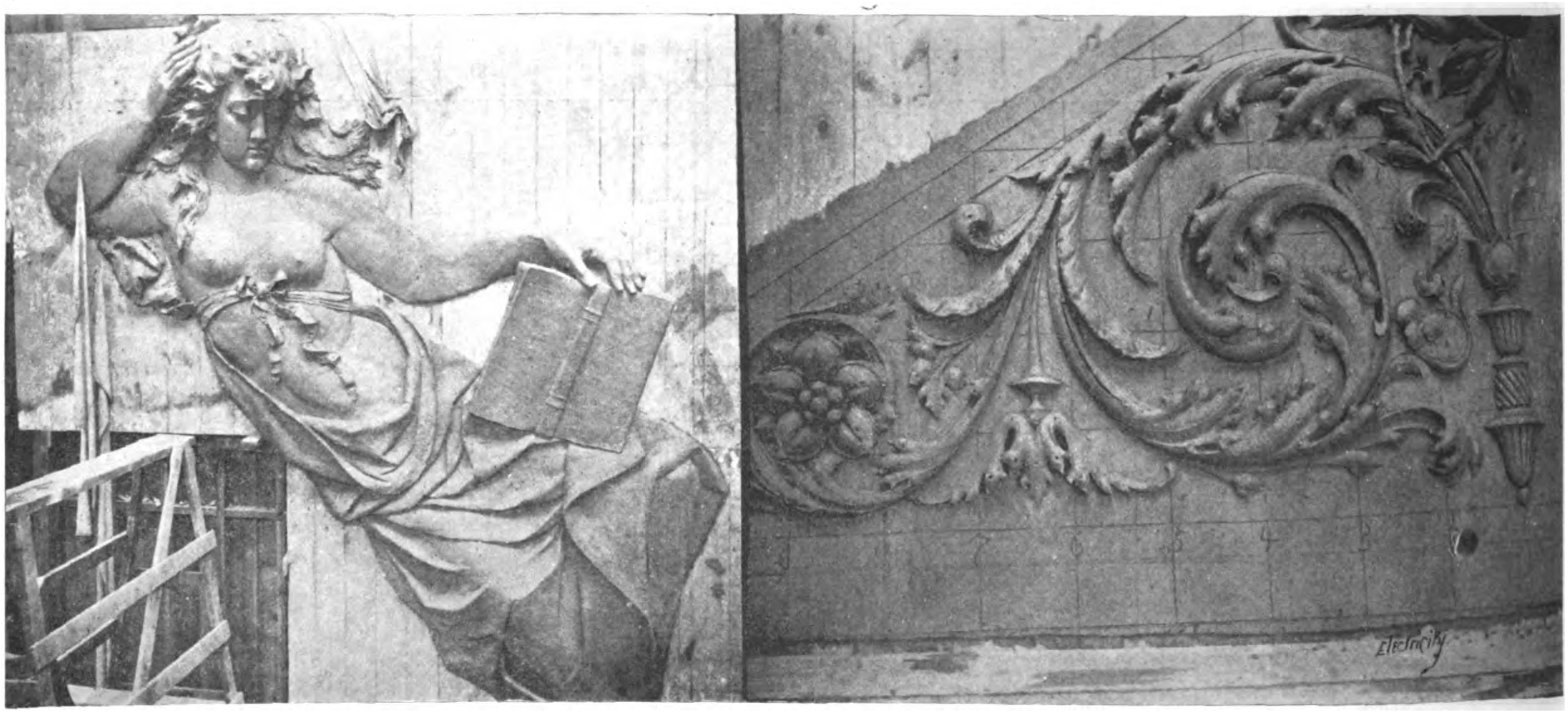
Distributed among the groups are battery jars, dynamos, field magnets and armatures of various designs, showing the artificial methods of generating electricity, while in the background is represented the world surrounded by the aurora and surmounted by a telegraph pole. This design is to occupy the central panel in the pediment over both the east and west main entrances to the Electricity building, and will be 26 feet long by 16 feet high.

The two extreme panels of these pediments will be occupied by the scroll work shown in Fig. 2. The panels are 14 feet at the base and 9 feet high. The graceful female figure given in Fig. 1, represents Science and is one of a pair which will adorn panels directly over the south and north main entrances. The size of this figure may be judged when it is stated that these triangular panels are each 27 feet high and 27 feet wide.

To the right and left of these entrances and on a level with the panel just mentioned there are two rectangular panels each 26 feet by 8 feet, in the centers of which will be placed the medallions of Morse and his coadjutor, Alfred Vail, represented in Figs. 3 and 4. (See page 88.)

Fig. 5 represents the Corinthian capital which will surmount the numerous pillars upholding the pediments over the four main entrances to the building.

ELECTRICITY is indebted to Messrs. Wm. Phillipson and Leopold Bonet for the opportunity of photographing the designs. As will be seen from the cuts the photographs were taken while the designs were still in the modeler's hands and with the exception of the frontispiece, which has not yet reached that stage, are still in the clay.



FIGS. 1 AND 2. DECORATIONS FOR THE WORLD'S FAIR ELECTRICITY BUILDING.

POSSIBILITIES OF ELECTRICAL DEVELOPMENT IN CANADA.

It is confidently predicted that one of the results of the Convention of the National Electric Light Association in Montreal will be to stimulate a more general interest in all matters electrical throughout Canada. The Canadians certainly should be especially interested in all systems for the electrical transmission of power. The Dominion possesses natural advantages which render it a magnificent field for the application of electricity on a general scale. Throughout Canada splendid water powers are available which at present are either going to waste entirely or else are utilized on a very small scale. This state of affairs is simply due to the fact that the practicability of using electrical power transmission has not been sufficiently pointed out. Those who have looked into the matter say that Canadians in many places still regard electrical transmission of power as rather visionary.

As the association meets in Montreal its influence should be felt, especially throughout Quebec. The statements made in regard to Canadian water powers in general are especially true of this Province. There is scarcely a town in Quebec without a waterfall that could not be used to advantage. In many instances the waterfall is located at some point where it cannot be employed directly; but if an electrical transmission system were installed an abundance of power could be made readily available in the town. If the statements of Montreal gentlemen are to be relied upon there is a large and profitable field of labor for American electrical companies in the Province of Quebec. They go so far as to state that when the facts are generally realized electrical companies will do a great deal of missionary labor in the field, and will be ready with their capital to build factories for the construction of electrical apparatus in Canada.

There is water power in abundance in many of the towns to furnish all the current needed for lighting, manufacturing and street railways. Ottawa, Ont., furnishes an illustration of what can be done in this respect. The power of the Chaudiere Falls is used by the two companies which furnish the arc lights, the incandescent lights and by the new corporation which operates the electric street railway. By no means all the power is utilized. Ottawa is a growing city and all the electric companies expect to make substantial additions to their plants in the near future. The amount of power which they draw from the river is, of course, a small fraction of what is used by the several manufacturing companies in Ottawa.

Power is required in Quebec, not only for lighting, and general manufactories, but it is also needed in the eastern townships for operating the mines. Waterfalls are available and only an effective system for transmitting the power to the mines is needed. The question of the application of electricity to mines formed a prominent topic at the Mining Convention which was held in Montreal in April last. Two representatives of electrical companies were present, and stated it as their opinion that Quebec offered marvelous facilities for the application of electricity to mining work.

STORAGE BATTERIES AND HORSES.

A valuable report on the working of surface railways by different methods of traction has just been made by the Birmingham Central Tramways Company, of Birmingham, England. This company operates a part of its system by electricity and a part by horses. The electrical equipment is composed of storage battery cars. It is found that the general expenses of electric traction such as wages, fuel, stores, etc., are 10.3 cents per car-mile, and adding machinery and car repairs, the total expense is 14.74 cents per car-mile. With horse traction the general expenses aggregate 14.66 cents per car-mile, or very nearly as much as the total expense for electric traction. For this part of the equipment of the car repairs only cost 1.08 cents per car-mile, making the total expense 15.74 cents per car-mile. The advantage in favor of electricity stands at 1 cent per car-mile, or about 7 per cent. Actually it is greater, as under car repairs the whole equipment of the electric cars is included, whereas in the case of the horse cars the cars alone are referred to, the renewal of horses and harness being charged to another account. It appears from this that storage battery traction can compare favorably with animal traction when given a fair trial.

ELECTRICITY

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In an article in this issue Ralph W. Pope discusses the "Influence and Benefits of Electrical Associations." The subject is a timely one, and the topic is handled in an entertaining way.

* * *

In the course of his article, which appeared in the supplement to the last issue of Electricity, H. Ward Leonard took F. B. Badt to task for statements contained in a recent publication written by the latter gentleman. Mr. Badt takes exception to the criticism, and his reply will be found on another page in this number.

* * *

This number of Electricity goes to press several days earlier than the date which it bears, in order that copies may reach those in attendance at the Convention of the National Electric Light Association at Montreal. It will be noticed that the issue contains considerable matter which will be found useful and valuable to those present at the meeting.

* * *

The members of the National Electric Light Association will doubtless be called upon to take some action in regard to the Electrical Department of the World's Fair. Prof. Barrett, the Chief the Department, will be unable to attend the meeting, but he will be represented by Secretary Hornsby. We doubt not that the association will do all in its power to further the success of the department by extending a hearty endorsement. The reports from the department have of late been of an extremely encouraging character. Whatever delays have occurred have not been caused by any inactivity of the officials of the Electrical Department. They thoroughly appreciate the importance of their work, and they propose to prosecute it vigorously in order that the section may be, as it should be, one of the most interesting, and instructive of the Exposition.

We called attention in a recent issue to the existence of an India rubber trust which was said to be engineered by Baron de Gomderiz with $25,000,000 behind him, and which promised to bring hard times to those employing rubber in their business. It seems that although the syndicate had 90 per cent. of the available supply under its control the immense capital at its back was not sufficient to hold this and to buy up the new crop now coming in. The unloading of 100 tons upon the market by certain persons was followed by a general break and rubber which had been forced up to 85 cents fell at once to 64 cents. The rubber trust is therefore a thing of the past.

* * *

We give in this issue an abstract of a paper by Prof. J. A. Ewing, F.R.S., on the influence of joints upon the magnetic circuit. The figures and curves given are exceedingly instructive and will be followed with interest by all those engaged in motor and dynamo construction. The results show conclusively how much is being sacrificed in magnetic conductivity by the usual facing of field magnet joints which must be classed as rough.

The figures given will enable the dynamo constructor to figure out whether or not the net results obtained would be greater or less by incurring the additional expense of facing his joints to a truer plane.

* * *

There is a vast opportunity for the application of electricity on a large scale in Canada. The possibilities are referred to in an article which appears elsewhere in this issue. The Dominion possesses innumerable water falls, comparatively few of which are utilized to furnish power. In a great many cases the location is such that the power can not be used directly, but if an electrical transmission system was employed they could furnish power in abundance for a great many towns in the Dominion. In some instances this policy has already been carried out, but even so, only a fraction of the water power is utilized. If a general interest was aroused in the matter of utilizing water power, makers of electrical apparatus would find Canada a promising field for cultivation. The economic results, according to well informed Canadians, would be of the highest importance to the Dominion generally, but to Quebec in particular. What is now needed, they say, is missionary work to apply the stimulus necessary to cause the people to seize the advantages which nature has provided. The advantages attending the use of electrical transmission systems should be emphasized. A step in this direction is the convention of the National Electric Light Association which is held this week in Montreal. The proceedings of the association will excite such general interest throughout Quebec that the people will begin to realize the extent of their natural advantages. At least that is the prediction which is confidently made.

* * *

A contemporary in commenting upon the suggestion made in our columns that an electrical congress be held during the World's Fair, says: "It has been suggested that the Association or the American Institute of Electrical Engineers assume direction of the congress; but a moment's reflection will enable any one to realize that such action would be ill advised." If our contemporary will look at the article again it will see that our contributor made no such recommendation. He suggests that the plan should be *taken up* and *discussed* by the above mentioned societies. The criticism that this suggestion comes in "poor grace to say the least," is retroactive, inasmuch as our critic further along endorses exactly the same action. It is true, that the Electrical Department of the World's Fair has had this plan under consideration and has already taken steps towards its accomplishment, and it was in furtherance of such action that we endorsed our correspondent's suggestions. The idea that the National Academy should stand sponsor for the invitation is, we think, a good one. Our contemporary is little familiar with the amenities among representative scientific bodies, if it thinks they would accept an invitation to be represented at a world's conference unless it came through the authority of a similar society whose position in the scientific world was recognized. The leading scientific societies of England, Germany and France would no more recognize an invitation from the Electrical Department than would those governments officially recognize an invitation from the department of manufactures or machinery. The invitations they do accept come by the authority of the United States Government. To have our invitation to a World's Electrical Conference accepted, it must come through the channel of highest dignity, scientifically speaking, and that channel is the National Academy. The steps taken by the Electrical Department are means to that end, and the suggestions of our contributor are in entire harmony with them. Our contemporary places itself in an anomalous position when it endorses editorially what it editorially criticizes.

* * *

The successful operation of the Richmond electric railway in 1887 was a most important event in electrical history. It has frequently been remarked by those who speculate in possibilities, that had the enterprise for any reason proved a failure, the electric railway interest would have received a set back which it could not have overcome in years. Doubtless this fact often terrified Mr. Sprague and his assistants, who had guaranteed to operate the road by electricity. The difficulties which beset them, and the obstacles which they were obliged to overcome were innumerable. Yet they were finally able to win a substantial and significant victory. Their success gave a veritable boom to electric railways, and its effect has not yet passed away. The time has come when reasons no longer exist for maintaining silence in reference to the trials and experiences of these pioneers in electric railway work. In this issue Mr. Sprague contributes some of his reminiscences which form part of the "Story of the Richmond Road." As a sketch of perhaps the most interesting event in electrical history in the last decade by the most prominent figures that participated in it, this article is entertaining in a marked degree. Written in the easy natural style characteristic of all of Mr. Sprague's contributions, the article will be found extremely attractive. In the installment of the article which appears in this number, Mr. Sprague first speaks of the execrable condition of the road as he found it and then describes at considerable length the trial trip. He can now afford to laugh at the very serious results of that experience, and he details in a humorous way the various mishaps which the party on board the car encountered, and the dismal, and humiliating end of the first trip

SPIRIT OF THE PRESS.

The daily papers contain curious paragraphs relating to electrical subjects. The following items were found in a batch of clippings sent to this office a few days ago:

Wichita street cars are to be provided with electric headlights to enable the conductors to slow up when cows are lying on the track.

A Rockford paper thinks the electric railway there ought to put cotton or something soft around the motors of the cars.

An electric railway car was run into one of Ringland's circus elephants at La Salle on Wednesday, but the big beast did not mind it.

A little boy fell into the electric light post hole at the Presbyterian church yesterday, and was in such a position that he had to be dug out for fear of breaking his leg. [Morris, Ill.]

The electric wire struck a mule in Mertens Sons' lumber team [Cumberland, Md.] The mule was knocked down and could not be relieved until the current was turned off. Fire flew from the wire in all directions and the mule kicked furiously but was slightly injured when relieved.

A lineman employed by the Swift Electric Light company, grasped a live wire, badly burning his hand. Strange to say he escaped with his life, though a current of 2,000 voltage power was proceeding from the dynamo with which the wire was connected. He took a firm hold, otherwise he would doubtless have been killed, as a slight contact is the most dangerous.

A Bloomington electric car got off the track the other day and there alighted four candidates for governor, one candidate for lieutenant governor, one candidate for State treasurer and three candidates for congress. This left only the motor man and he confessed to a reporter that he hoped to receive an appointment as janitor in the State house when the Democrats came in power.

ELECTRIC UNICYCLE RAILROAD.

Texas capitalists were in Chicago last week, and took preliminary steps to secure a franchise for an elevated electric road from Lake street to the World's Fair grounds at Jackson Park. Thomas J. Hurley, who represents the syndicate, is president of the Texas World's Fair Exhibit Association. He said last week he had been impressed with the inadequate transit facilities to Jackson Park, and had determined to build a road on a system invented by E. W. Turner, of Fort Worth, Texas. Said Mr. Hurley: "The technical name of our system is the Unicycle Electric Elevated Railroad. It is the invention of E. W. Turner, of Fort Worth, Texas. While the system has never been operated on an extensive scale, we are ready to guarantee that it will be a success. A half mile trial line is now in operation in St. Louis. The cars run on a single track, getting their power from an electric rod under the body of the car. This system is the most rapid in operation. We can attain a speed of 100 miles an hour without any difficulty, and the run between

Fig. 5. Decorations for the World's Fair Electricity Building—Corinthian Capital. (See Page 88.)

Lake street and Jackson Park would be made at the rate of forty miles an hour, including stops."

UNIVERSITY OF WISCONSIN ELECTRICAL DEPARTMENT.

A circular of information relative to the college of mechanics and engineering has just been issued by the University of Wisconsin, at Madison. The reorganization and enlargement of this branch of the university are fully described. The change in the electrical department is particularly noticeable. Professor J. E. Davies takes the chair of electricity and magnetism and Dougald C. Jackson, lately electrical engineer of the Edison Company, of Chicago, the chair of electrical engineering.

THE STORY OF THE RICHMOND ROAD.

BY FRANK J. SPRAGUE.

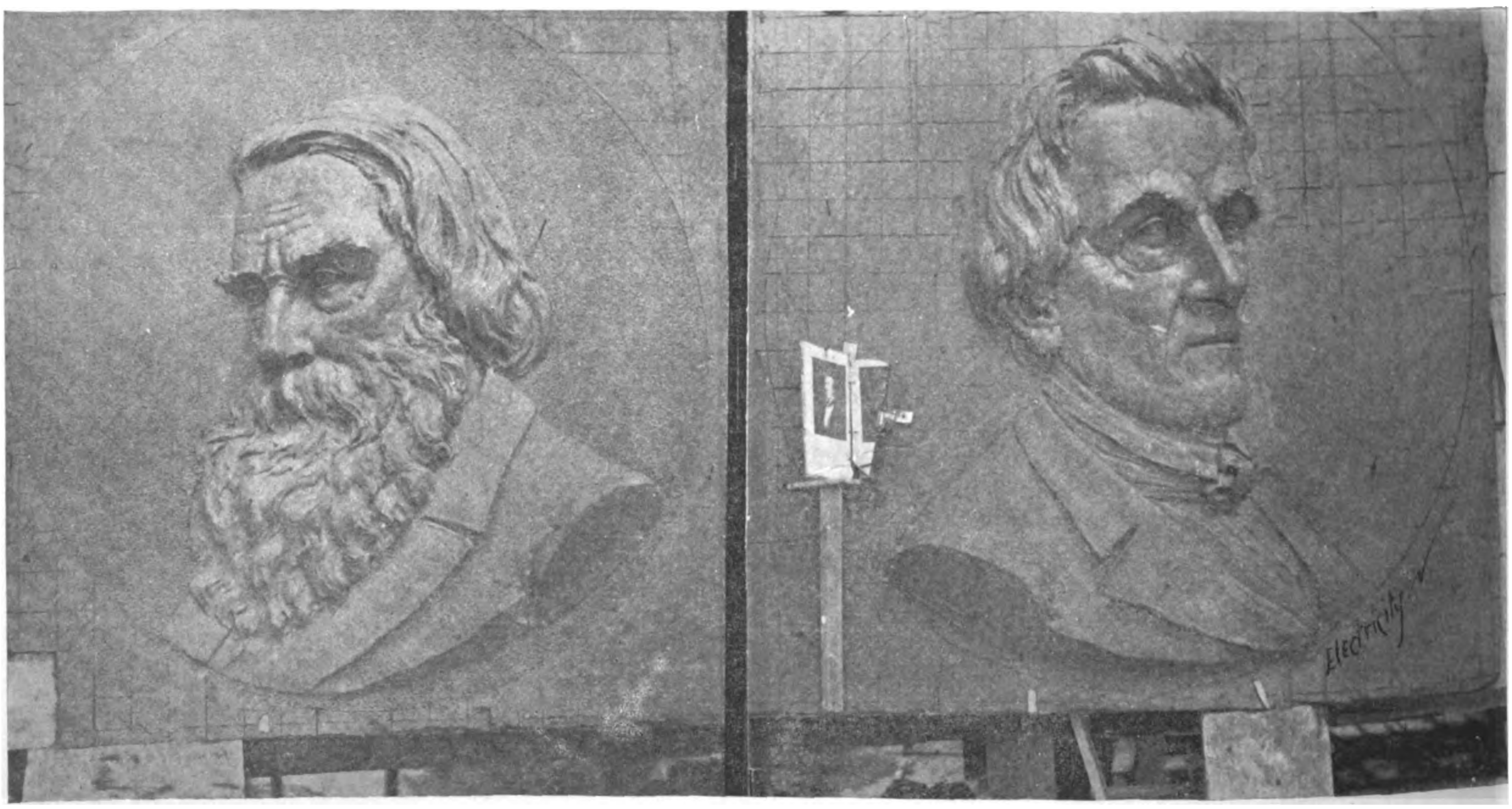
Part I.

I hardly know how to answer the request of the editor of Electricity to give some reminiscences of Richmond. The strong personal interest which I had in that road might perhaps excuse me for lingering over some of my early experiences there, and I have sometimes thought perhaps it a good thing for the rising generation of electricians to have a full account of the difficulties there met and overcome, and the many experiences common to every man connected with that road. Although I may possibly some time look over the records of that work and write a short account of it in detail, I feel that the general public has, perhaps, heard all of Richmond they care to.

I picked up a letter copy book to-day and my eyes fell on a letter written the 7th of February, 1888, beginning after this fashion: "My dear Greene: It is a $?$? isn't it? I am doing everything in my power here to get out something to stop this infernal trouble with the commutators"

The average electrician will interpret this opening sentence according to his early religious training. It certainly, at the time, expressed somewhat forcibly the feeling which actuated probably every one connected with this road. Looking back at the difficulties which confronted us week after week and month after month, perhaps honesty would compel me to say that had they been known beforehand, and the solution of them not foreseen, few, if any, of us would have had the courage to have commenced the work; but fortunately, I think, for the future of electric railways, and certainly fortunately for the pecuniary interests of myself and others, these difficulties were many of them unforeseen, and did not have to be met all at once.

It will be impossible for me to give you at this short notice any connected story of our experience, and I will content myself, and I hope it will answer your purposes, to simply chat a little, if I may. The contract for the Richmond road was not one which a prudent business man would ordinarily assume, especially in view of the unprepared state, speaking both from a financial and a



Figs. 3 and 4. Decorations for the World's Fair Electricity Building—Medallions of Morse and Vail. (See Page 88.)

technical point of view, of any company to undertake a work of this magnitude.

The contract was made with Mr. Johnson's and my approval in May, 1887, by our very wide-awake agent, Mr. Harding, than whom perhaps none was more enthusiastic, and it called for the completion in ninety days of the equipment of a road having about twelve miles of track, at that time unlaid, and the route determined only in part; the construction of a complete steam and electric central station plant of 375 horse power capacity; the furnishing of 40 cars with 80 motors and all appurtenances necessary for their operation; 30 of these cars were to be operated at one time, and grades as high as 8 per cent. were to be ascended.

My immediate assistants were two young officers; one, Lt. Oscar Crosby, a graduate of high honors of West Point, and the other, Ensign S. Dana Greene, who had taken the honors of his class at Annapolis, which was my own alma mater. Both were totally inexperienced in electric street railway work, but each had energy, pluck and endurance. Shortly after this contract was made, and by the way we had to run successfully for sixty days before a dollar was due, overwork and exposure brought on an attack of typhoid fever, and in the latter part of July I was laid up in a sick room with strict orders for absolute cessation from business worries. As soon as I was able to get out I went on a convalescing tour, so that I was at a very critical period absent from work for nine weeks, leaving almost the entire burden on those who had been with me.

When the contract was taken we had only a blue print of a machine and some rough experimental apparatus. The hundred and one details which were essential to success, were, as yet, undetermined. During my absence, however, everything which could be done both in New York and Richmond was done by those in charge, Greene being in Richmond, and Crosby at the New York works.

I came back about the first of October. Up to that time I had never seen the Richmond road. Much of the track work, I believe, was then finished, poles had been set, many of the machines constructed, experimental work on the machines, controlling switches and trolleys under way. The syndicate with whom we had contracted were clamorous for the work to begin; the excuses on our part were without number. I hastened to Richmond to go over the road, note the condition of work, and see what the prospects were. I shall never forget the feeling which I had after going out to the improvised car sheds at one end of the line and on returning reached the foot of the Franklin Street hill. As I looked up this, under the bridge connecting the Ballard and Exchange Hotels and saw a street with a grade varying from four to ten per cent. rising beyond the bridge, my heart almost sank within me when I realized what it was necessary to overcome. The condition of the track was simply execrable; it was laid for profit, not for permanence. A flat twenty-seven pound tram-rail of an antiquated shape, poorly jointed, unevenly laid, insecurely tied, were its characteristics. Its foundation was red clay.

The curves were sharp, some as low as twenty-seven and thirty feet radius; they had but one guard rail, and they were continually spreading. Our car house was an open lot in which were two roughly covered sheds. We had undertaken the problem, at that time entirely new, of gearing motors independently to each axle, carrying them under the car exposed to dirt and moisture, to control them from either end by new methods, to run with fixed brushes in both directions, to operate without rheostats, to use a four hundred and fifty volt constant potential circuit under conditions which were stated by electricians to be impossible, to operate a multiple arc circuit on a large scale, which was deemed equally impossible, to use a trolley wire of small size supplied at intervals by a system of large conductors, and to mount grades which we found much more severe than we had contracted for, and which had also been pronounced by street railway men and electrical engineers as impossible of ascent by a self-propelled car. The sight of this grade was probably one of my most unpleasant sensations. I felt that there were two things probable; first, that the car would not ascend the grade, no matter how powerful the machines, for lack of track adhesion, and second, that the machines were not powerful enough, even if the wheels would cling to the track; but we were face to face with the problem—and it must be solved.

We had built very light machines with one reduction of gearing, to which street railway practice is now again gravitating, and the torsional effort of these machines, while great, was not sufficient for the duty now demanded of them. An eight per cent. grade would strain them, a ten per cent. would be fatal. I hastened back to New York for a consultation as to what we had better do. Should we operate the particularly heavy grades with a cable to be run by electric motors in sunken pits underneath the track and depend upon motors for the regular duty on the rest of the road?

This seemed feasible if the cars could not by their own adhesion mount a ten per cent grade. On the other hand, if a car did have sufficient adhesion to mount this grade, it was plain that there must be a change in the machines. We must double the reduction of gearing and this was a serious problem to face. I remember a little conference which Mr. Johnson, Mr. Harding and myself had in our office at Broad street, and Johnson's laconic remark, "guess the best thing to do is to find out whether the car can get up the grade at all."

This was sound, and as soon as we were ready for the trial I went to Richmond, and one night about nine o'clock we started out. We had on board a number of our employes and General Manager Burt, who was in Richmond representing the syndicate's interests, and who had at one time been the general manager of the Panama Railroad. A short distance from the end of the line we stopped in the middle of a very sharp curve. Burt thought we could not get out of it; I said we would if I wrecked the machines, and out of it the car came. No more enthusiastic man I think was on the car that night than Burt himself, after seeing that exhibition of what a motor could do when pushed to abnormal strain.

The run to the foot of the Franklin Street hill was distinguished by one free fight in which an energetic inhabitant, rather the worse for liquor, nearly cleaned out our party; until one or two of our best fighting men got into trim, after which we had a reasonable amount of peace. Arriving at the foot of the hill we stopped, and I said: "Burt, we won't make it! He said, "You will; if you can get out of a curve such as we left some time ago, you can go up the side of a wall." I offered to bet him five dollars—needless to say I was in hopes I would lose. If we succeeded in climbing the hill I knew what would happen to the machines; but it was vital to know whether a self-propelled car could be gotten up that grade. We went steadily up until we got to the top of that and another hill, and had gone around several curves, finally reaching the highest point of the line in the heart of the city. We stopped here, for I knew that everything under the car must be pretty nearly red hot, and an enthusiastic crowd soon gathered around us. Of course, I was willing that they should inspect the car, for all the time I was in hopes it would cool down sufficiently for us to continue our journey; but my hopes were doomed to disappointment. No sooner had we started than I felt that peculiar movement, then strange, but afterward very familiar, due to a crossed armature, and I knew that we were disabled. We ran on a block in our crippled condition, and then I stopped while a howling mob, numbering over two or three thousand seemed bent on taking possession. It would never do to confess serious trouble, and so I told Greene in a tone that could be overheard by those near me, but apparently showing no concern, that we probably had some slight trouble with the circuits, and I thought he had better go and get the instruments so that we could locate it, and then we would be all right. Then I turned out the lights and lay down on a seat to wait, hoping that the crowd would disappear. After waiting a long time for Greene's return with those urgently looked for "instruments," inwardly praying that he would be late, he hove in sight with four of them—big, powerful mules, the most effective instruments which we could find in Richmond under the circumstances, and we began our retrograde journey, at first with the mules in the rear.

I was not satisfied to go back in tow, and so cutting out the disabled machine I at first thought we would make an attempt to get home with the other one. We were on the wrong track. We had severe grades and curves to meet, and I knew it to be a doubtful feat. As we approached one of these curves on a down grade, which was succeeded by a sharp rise, I shouted to everyone to jump and stand by to give a hand to shove, and turning the switch on to a position of full speed ahead I made a shoot for this curve at a pretty high rate of speed. Before I realized where I was, the car had left the track and knocked one of the foundation stones of the hotel nearly out of position—damages subsequently paid cheerfully.

The few spectators remaining granted that the machines had power, and having pretty well smashed up the car, I then felt that I could reasonably ask the help of Greene's crew.

This was one of many similar night experiences, but the experiment had been a critical one. We then knew that with all of the weight of the car being used for traction, at least a 10 per cent. grade could be ascended, but it involved the solution of a most serious mechanical problem. Distance between centers of armature shaft and car axle was about 12½ inches. It was necessary to introduce in this space an intermediate gear on a machine apparently incapable of being adapted for one.

I hastened back to New York and we hit upon the idea of putting a stud on one end of the machine carrying a gear and a pinion of small size, into the former of which the armature pinion should mesh, and the latter should engage the teeth of an internal gear on the car axle. Happily the strain on the stud was largely relieved because the moments were equal and opposite on the same side. I think no other possible method of operating this machine could well have been devised. I went to Providence to the Brown & Sharpe Manufacturing Company, who had done considerable work for me, told them my difficulties, how vital every day's delay was to us, and laying the drawings before them said that I wanted them, night and day, without regard to cost, to bend their energies to getting out a set of tools and jigs which would permit us to alter our machines in Richmond, and at the same time to make the necessary patterns, some of them very difficult, and to cast the requisite gears. They responded nobly, and in a few weeks our tools were ready, the machines in Richmond were changed, the new gears made, and we were again ready for running.

(*To be continued.*)

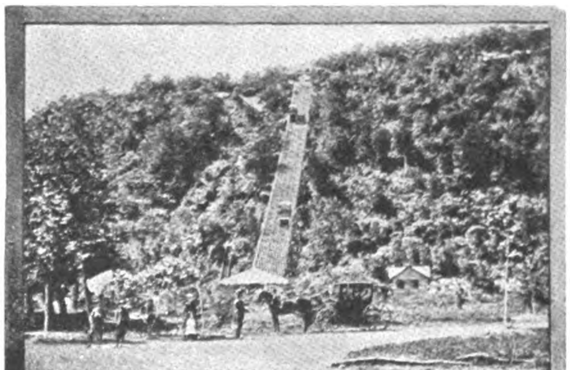
MONTREAL AND THE NATIONAL ELECTRIC LIGHT CONVENTION.

In the last two numbers of Electricity some of the most interesting electric light stations in Montreal have been illustrated and described. One of the handsomest plants in Montreal is that of the Canadian Pacific Railroad. It is located

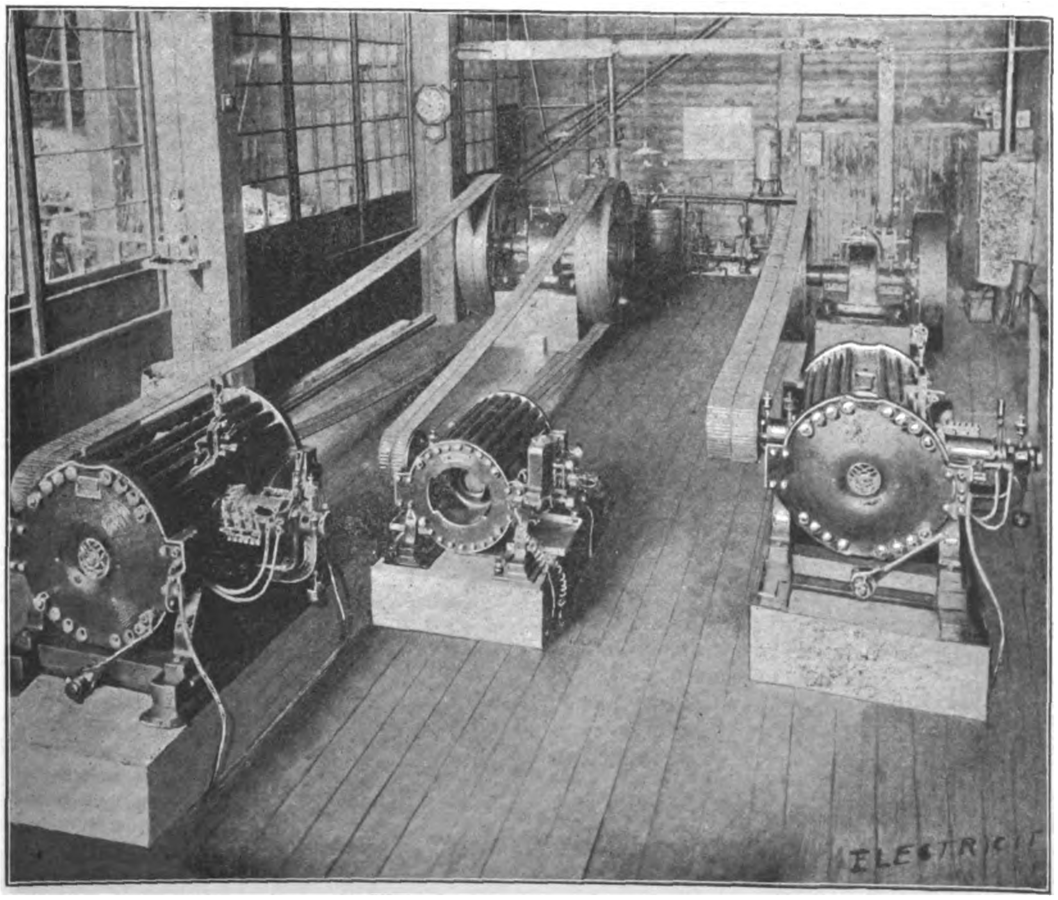
Parish Church of Notre Dame, Montreal.

in a building which adjoins the magnificent depot of the company. This latter structure is built on lines which remind a Chicagoan of the Auditorium. The plant shown in the cut consists of two three hundred light Thomson-Houston incandescent dynamos, and a twelve-light arc machine. The latter machine was constructed by the Royal Electric Company. The engines, one of thirty-five and the other of sixty-five horse power, were constructed by John Doty, of Toronto. Steam for the plant is generated in a 100-horse power Doty boiler. The plant is in charge of William Allan.

The Perrault electric light station is located in the Perrault building on St. James street, near the Place d' Armes Square. Originally a single Thomson-Houston dynamo of 300 lamps capacity, was installed for lighting the building, but the demand for light and power became so great that four machines of the same capacity are now operated and an extensive enlargement of the plant is contemplated. Power is supplied by a 100-horse power Corliss engine, made by Laurie Bros., of Montreal, and a Leonard-Ball engine, built by Leonard & Sons, of London, Ontario. About 2000 lights are now connected on the circuits together with several motors used in manufactories. No poles are used but wires are carried on stands located on the roofs. A number of Universal arc lamps are operated on the incandescent circuit, and are found to give entire satisfaction. They are connected on a separate line. Fourteen of these lamps are furnished with current at a distance of 2,000 feet from the dynamo room. The longest circuit is about four miles. The employes of the station do all the wiring inside of building, and conform to the rules of the underwriters in vogue in the United States. Habirshaw wire is used for inside work. The customer is charged a certain price for all inside work. In the event of his failure to pay his bills the fixtures, etc., revert to the owner of the electric light plant. Thomson-Houston and Sawyer-Man lamps are generally used. A few lamps made by Gerard, of Paris, have also been employed, and have given satisfaction, though they are rather expensive. The demand for current has been so great that a material increase in the plant will be made, as already stated. The increase will include four Thomson-Houston 300-light machines, one alternating current dynamo, a Corliss engine, and a Heine boiler. The electrician in charge of the plant is Louis Gouillioud.



Inclined Plane at Mount Royal—Montreal.



Canadian Pacific Electric Light Plant, Montreal.

The most unique electric light station in Montreal, as far as location is concerned, is that in the Parish Church of Notre Dame. This edifice is perhaps the most noted in the city, and will be visited by all those who attend the convention. The plant is located in the basement of the church and consists of two of the motor type Thomson-Houston dynamos manufactured by the Royal Electric Company. One of the machines is of 400 light capacity and the other of 100 lights; power is furnished by two high-speed engines of of 40-horse power each, manufactured by the Woodbury Engine Company, of Rochester, N. Y. Each engine will operate both the dynamos. Steam is generated in a Babcock & Wilcox boiler of 60 horse power capacity. The lights are so distributed about the church that they give an excellent general illumination. On the main floor the lamps are arranged at the three points of the crosses which separate the pews. A large number of lamps have been used for the illumination of the altar, and the delicate wood traceries in

Victoria Square, Montreal.

the sanctuary. The effect of the sudden illumination of this portion of the church is exceedingly striking and beautiful. The chapel which is now almost completed, as an addition to the main edifice, is also to be electrically lighted. This portion of the church is exceedingly beautiful and the wood carvings are of exquisite design. To appreciate thoroughly the beauty of the work, considerable light is needed. It is not unlikely that a storage battery plant will furnish current for the chapel.

One of the most prominent buildings in Montreal is that of the New York Life Insurance Company, located at the corner of St. James street and Place d' Armes Square. The structure is illuminated throughout by incandescent lamps. The plant is located in the sub-basement, and was furnished complete by the Brush Electric Company, of Cleveland. The two dynamos, which are compound wound, are of 600 and 400 lights capacity. They are driven direct by two McIntosh & Seymour high-speed engines. Three Babcock & Wilcox boilers, each of 75-horse power capacity, furnish the steam required for the engines, and for heating the building. Grimshaw wire is used throughout the building. There are in use in the building 1,000 incandescent lamps. The switchboard is complete in every detail, and as it is constructed of marble, it is a beautiful piece of work.

The electric light plant of the Montreal *Gazette* consists of two Edison dynamos, one of 800 lights and the other of 600 lights capacity. They are driven respectively by a 150-horse power engine, made by Laurie Bros., of Montreal, and a 60-horse power automatic Armington & Sims engine.

The plant, besides supplying light for the *Gazette* building, furnishes light for the Postoffice, Bank of Montreal, Bank of Commerce and several

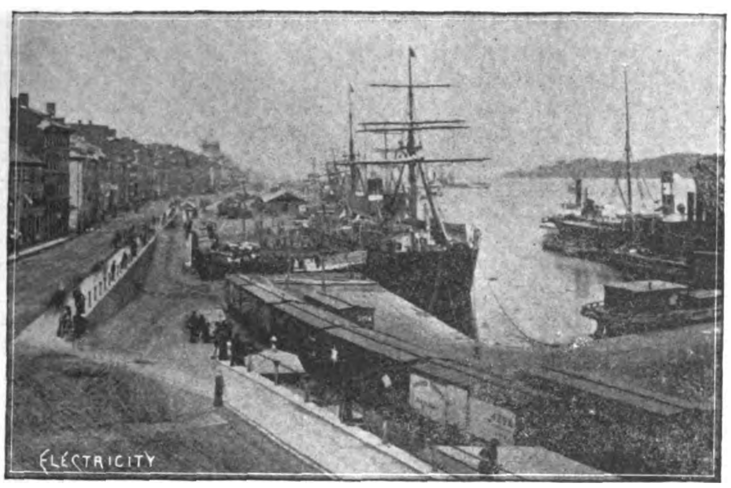
Montreal from Notre Dame Tower.

stores. It also supplies current for several motors, one of which is used by the telephone company.

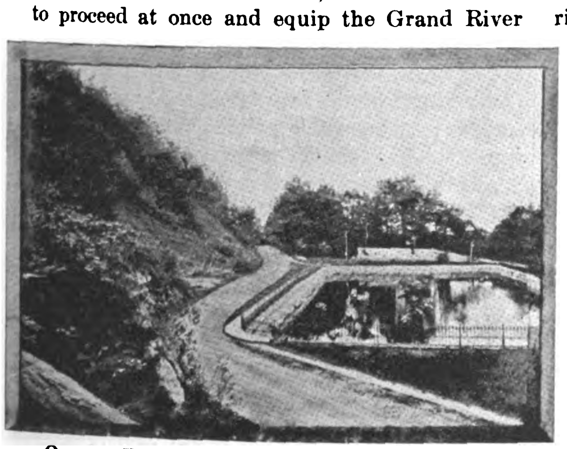
ELECTRIC RAILWAYS FOR DETROIT.

W. B. Cook, president and J. B. Mulliken, general manager of the Detroit Street Railway Company, recently made an inspection of street railways in several cities. Their conclusions, as stated to a reporter, were as follows: "Taking into consideration speed, noise, ease of running and quickness of stopping the overhead wire system must be conceded to have very superior advantages over any other. A cable is very noisy, very expensive to run, and in Cleveland we found that it was blocked for several days by a heavy storm last winter, while the electric lines were practically unimpeded.

"Now, as to immediate prospects of a change in Detroit," continued Mr. Cook, "we have decided to proceed at once and equip the Grand River avenue system with the Rae system of electric cars. We shall put in the track at the same time that the avenue is paved, and we believe the council will order the pavement at its meeting to-morrow night. When the system is in operation we believe the people of the other avenues and streets will be so favorably impressed as to ask for it."



Shipping at Montreal.



On the Road to Mount Royal, Montreal.

A Montreal Residence.

MANUFACTURING COMPANIES AS EDUCATORS.

BY J. STANFORD BROWN.

In the description given by a contemporary of a new type of dynamo just placed on the market occurs the following:

"The projecting (armature) coils are, in fact, a sort of fan, and in standing before the machine the current of air set in motion by the armature can be detected ten or fifteen feet away. *As a consequence*, both armature and field run cool, and it is almost impossible to burn out a coil even with heavy overloads."

The "boom era" has, let us hope, begun to pass in electric light and power circles. Machinery is being designed to-day no longer by "rule of thumb" and "try, try again methods," but with a thorough theoretical knowledge of the principles involved, both electrical and mechanical.

Our leading electrical papers have realized that the "blow your horn, John, if you don't sell a clam" policy only draws ridicule and pity from able minds, and detracts from the dignity which they must uphold as instructors in the great field of both theory and practice.

Such being the case, the time too has gone by when selling agents claim unlimited candle power per horse power, and other impossibilities for their pet system, chancing it that the "other fellow" will not hear of it in time to undeceive the ignorant (?) purchaser (now happily disappearing from view), even if he knew enough to do it, and to lay down some equally preposterous proposition regarding the superiority of his own devices.

Why is it that the large manufacturing companies still permit in the descriptions of their machinery statements which are on their face ridiculous, or claim superiority for points of construction which, were they otherwise would prove the company's engineers woefully ignorant of the principles involved in the design.

These descriptions are published wholesale, and sent with cuts to all the leading mechanical and electrical journals, not of their own country alone, but to those published in foreign countries.

The illustrations, and frequently the printed matter, are cut out for scrap-books by electrical students everywhere, and the mis-information thus acquired is treasured up and propagated, and not until the victim has placed himself in a ridiculous position by asserting as facts the greatest absurdities does he realize, to his cost, his mistake.

Then, too, these wild statements are frequently copied into the elementary books, the so-called "popular treatises" of the day, where of all places scientific accuracy should be found, but where it is more often lacking.

It is not intended to criticise the dynamo, in the description of which the sentences quoted were penned, for it shows unmistakable evidence of good points in design and workmanship, although there did seem room for difference of opinion as to which should be pointed out with emphasis. Nor was its manufacturer selected other than by chance. The criticism, if it is a valid one, is true of them all, big and little, to a greater or less degree.

The point to be emphasized is that the big companies are great educators, not only of the men in their works, where some of them provide a sound course, in technical instruction, and of the men in their outside engineering (construction) departments, but also indirectly of all students of electrical manufacture and engineering. As such it would seem as though they had or should have a responsibility and feel it important that all information regarding their products or work be such only as will help and enlighten all who see it.

Such a course cannot but help them more efficiently, likewise, in its immediate bearing upon the purely commercial side of their business.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

Director General Davis has asked Secretary Hornsby to deliver an address before the National Electric Light Association, in response to a request from President Huntley, of the association.

Boilers for the temporary electric light plant have arrived and will be placed in position immediately. The engines and dynamos are expected within a short time. When this plant is completed, the grounds will be thoroughly lighted by arc lamps, placed in convenient places, so that construction work can be carried on during the night.

Prof. Barrett finds that it will be impossible for him to attend the Electric Light Convention at Montreal. Secretary Hornsby, however, will answer all questions relating to the World's Fair.

COST OF TELEPHONE SERVICE.

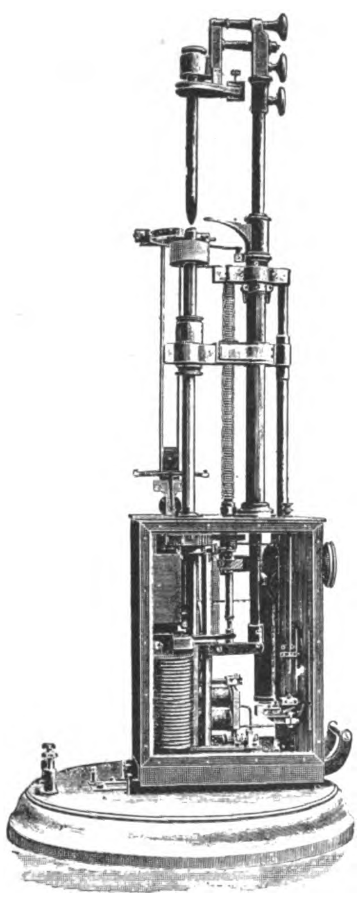
In an editorial in one of the New York dailies reference is made to a company which claims to have acquired the exclusive right to sell Bell telephones "for export to South America and elsewhere," and the fact that while in those countries a complete outfit a mile long costs less than $50, subscribers in the United States have to pay from $100 to $150 a year for telephone service, is treated as very much of a grievance. The writer of the article evidently loses sight of the fact that the people who buy telephones in the countries in question have to fit them up and work them themselves, and in any case their outfit covers but a single line, a mile long, with only two stations, whereas connection with a telephone exchange in this country means the possibility of connecting with anywhere from 10,000 to 60,000 subscribers. Question may be taken on the last named figure; but when the fact is taken into consideration that so many towns are connected by the long distance lines, and that any subscriber in one town can reach any subscriber in another, this estimate is well within the mark. In order to provide the facilities for giving this service the telephone

company has to have immense plants, and to go to enormous expense in maintaining offices, large staffs of employes, etc., and the idea of instituting a comparison between the service in this country and in South and Central America is absurd.

NOVEL ARC LAMP FOR LIGHTHOUSES.

At the Moscow Exposition was exhibited an arc lamp for lighthouse purposes that possesses some exceedingly novel features. The lamp, a cut of which is given, is intended for continuous currents. The positive carbon is placed beneath instead of above, as is more usual. In order to maintain an unvarying position of the arc with regard to the axis of the carbons, use is made of the action of one current upon another, discovered by Ampere, by surrounding the end of the positive carbon by a solenoid. This solenoid, through which the current passes, acts as a circular magnet that compels the arc to follow its axis, and in practice the fixity of the arc is found to be practically absolute.

The feed is accomplished by an automatic thermal regulator which consists of two strips of met-



ARC LAMP FOR LIGHT HOUSES.

al having different coefficients of expansion, which open or close the circuit of a relay placed in the case of the lamp. On this regulator is thrown a beam of light refracted from the arc by means of a special lens placed in the focal plane. When the crater of the positive carbon is consumed below the focal plane, the luminous beam projected by the lens is thrown in a different position on the blades of the regulator. The heat of this beam is sufficient to effect the unequal expanding properties of the metal, and the movement thus produced varies the contact with the relay. Throwing in the relay sets in operation a small motor which raises the positive carbon to its required position.

The regulation is said to be extremely sensitive and careful experiments have shown that the greatest variation does not exceed one-half millimeter from the focal plane. This lamp is made by Sautter, Harle & Co., of Paris.

INFLUENCE AND BENEFITS OF ELECTRICAL ASSOCIATIONS.

By RALPH W. POPE.

The advantages of associated effort in every branch of progress, are now so thoroughly understood and appreciated, that the general question of organization may be accepted as settled. The individual depending solely upon his own resources would relapse into barbarism. By cooperation and the division of labor, civilization is possible, and progression is the natural sequence. The printing press, the steam engine, and the telegraph have stimulated the interchange of ideas, but the brain of the inventor has been the pioneer, laying out the lines to be followed by the trained eye and skilled hand of the mechanic. Life is too short for a single mind to grasp the entirety of a great invention, which is the result of cumulative effort. Whatever tends to impart the earliest knowledge of new devices or processes, hastens their development and improvement, by bringing to bear upon them the close attention of hundreds of minds where possibly but one was devoted to it before. This is the basic principle of association, more especially for the discussion of electrical and kindred subjects.

It is frequently argued by men who are considered intelligent, that the modern journal renders the association unnecessary. Experience, however, proves that the presentation of an important professional paper, will frequently develop a discussion, bringing to the surface ideas which have lain dormant for years, and otherwise might never have been made public and placed on record. Granted that the individual thus yields up a secret, which a more selfish person might have retained for his own advantage, still the general result is beneficial and it is very frequently the case that by so doing others are led to offer their own in exchange, so that in the end the original speaker may prove the gainer, by receiving more valuable information than he imparts. It is a well known fact that while it might be practically impossible to secure a written opinion from gentlemen whose professional standing is the highest, they will freely impart valuable information when upon the floor, simply because they are present; little effort is required to do it; and like a speaker in a prayer-meeting, they are moved by the spirit. It will therefore be seen that while the association is beneficial in stimulating thought, it is also of great value in making public, ideas and suggestions, which would otherwise have remained in obscurity. Such ideas may be so simple that by themselves they would scarcely be considered worthy of publication, yet as part of a discussion they are by no means insignificant.

One of the most important missions of a strictly professional society is, that it imparts to the general interest which it represents, a character which it otherwise would not attain. There are, for instance, a great many people identified with electrical progress, who are loth to admit that there is any reason for the existence of the electrical engineer. An engineering directory is now being compiled, in which the classification is confined to civil, mining and mechanical engineers. The character of the work, and investigations of electrical engineers, as shown in the papers prepared by them, will eventually lead to the correction of such an oversight.

It is also argued that unless great care is exercised, the association is liable to misuse by becoming the channel for gratuitous yet effective advertising. It should always be borne in mind that the association exists primarily for the benefit of its members. They are interested in obtaining information regarding what is new and good and exposing whatever is false or useless. If through the agency of the association a new and good device or practice is made public, its members are benefited to a certain extent, while it may also be true that the author of the paper receives his reward in a more tangible form. It may be set down as practically impossible to read a meritorious paper before an association without affording the author an opportunity of gaining some benefit therefrom, to which most of his colleagues will admit he is clearly entitled.

It is the general practice of American associations to permit the publication of such of their papers as may be desired by the electrical journals. In most cases an abstract of the discussion is also published. Those societies which print their transactions, however, embody both papers and discussions complete, usually revised by author and speakers. By general publication in electrical journals, thousands are enabled to profit by the proceedings of societies which they do not directly support, and there is no doubt that for this reason many refrain from becoming members, believing that they secure all the advantages without expense.

On the other hand, the society by making known its work to the greatest number of people, secures valuable members, who but for this general publication of its proceedings might not be aware of its existence. The greater circulation it can give to its papers and discussions, the more widespread will be its influence and the greater its prestige.

There is other important work frequently undertaken by the older engineering societies, which is within the province of electrical associations. That is the carrying out of tests and investigations by committees, which frequently occupy much valuable time and special facilities requiring an expenditure of money beyond the ordinary running expenses. Work of this kind is now either done at college laboratories or in the interest of companies or individuals, and the results are not always accessible to the public.

Those associations which are devoted more especially to the commercial application of electricity, of which the National Electric Light Association is an example, accomplish great good by the comparison of methods, leading to the most economical and substantial construction of lines and stations, and the highest efficiency in their operation. It is true that the lessons learned are not subsequently introduced in practice so generally as might be expected, but this is not the fault of the asssociation.

The growth of an association is similar to that of the individual. Its birth arouses a certain amount of enthusiasm and curiosity, but after this passes away there arrives a period when people are somewhat in doubt as to whether it will ever amount to anything or not. As it attains age and experience, and builds up a record of usefulness, it attains a certain amount of influence. Having arrived at this stage, it will receive hearty support if it really has a legitimate field of operation, and is properly managed.

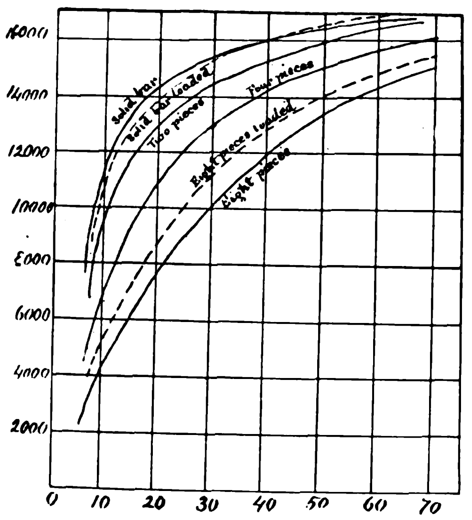
The benefit of the association to the individual member may be readily pointed out, but he is expected to share in the general good, and should not claim any personal advantage as being due to him because of his affiliation. The associations in question are neither of the trade-union nor mutual benefit type. They do, however, bring together men of similar tastes and training, and by the mere extension of one's circle of personal acquaintance, enlarge his opportunities for advantageous business relations.

The opportunity afforded members, either of preparing or discussing papers, brings them into public notice, and if unusual ability is displayed their services are sought for, because competent men are always in demand. Unless a man has attained the highest possible rank, he will find that his position is thus strengthened, and that there is an appreciable rise in what may be termed his commercial value. The mere fact of membership, however, is not sufficient in itself to raise a man above his natural level. The association affords

an opportunity for a man to show his ability. If he does not possess it, or if possessing it he does not care to display it, he will in most cases rest satisfied with being an integral part of an association in which he feels a certain amount of pride because of its standing in the community. There are men in every profession, who attempt to convey the impression that there is nothing more for them to learn. There are others who strive to belittle the achievements of their rivals or competitors. Some are inclined to sneer at the meagerness of the scientific knowledge with which many of the early workers were equipped. Experience shows, however, that very few men of this character find their way into associations. The general disposition is to award credit where credit is due; a natural result arising from personal acquaintance which frequently brushes away that feeling of prejudice which sometimes exists toward people known to us only by reputation. The building up and cementing of friendships is by no means the least of the benefits of electrical associations.

MAGNETIC RESISTANCE OF JOINTS.

In the last number of ELECTRICITY was given an abstract of the first part of Prof. J. A. Ewing's



EFFECT OF SUCCESSIVE CUTTING.

paper on the "Magnetic Resistance of Joints." A summary of the remainder of the article follows:

EXPERIMENTS WITH ROUGH JOINTS.

Others of the experiments dealt with bars simply cut in the lathe without scraping the cut ends to perfectly true planes. Joints of this kind, which by comparison may be called rough, were found to offer rather more, but not very much more, resistance than carefully faced joints so long as the cut bar was tested without compression. But under compression the difference between a rough and smooth joint became very manifest; the resistance of the rough joint was comparatively little reduced, and altogether refused to disappear even under the most intense stress.

The following table shows the effect of successive cuttings in an iron bar, the joints being in every case of this comparatively rough kind. The bar was tested first in the uncut state; then when cut into two, four and eight parts, the ends being put in contact without compression.

EFFECT OF SUCCESSIVE CUTTINGS.

Magnetizing force due to solenoid	MAGNETIC INDUCTION.			
	Solid Bar.	Bar cut in Two.	Bar cut in Four.	Bar cut in Eight.
7.5	8500	6900	4800	2600
10.	11000	9000	6400	3770
15.	13400	11550	8900	5550
20.	14400	13000	10750	7150
30.	15350	14550	12940	9800
50.	16400	15950	15000	13300
70.	17100	16840	16120	15220

In the accompanying cut these figures are plotted in the form of full lines.

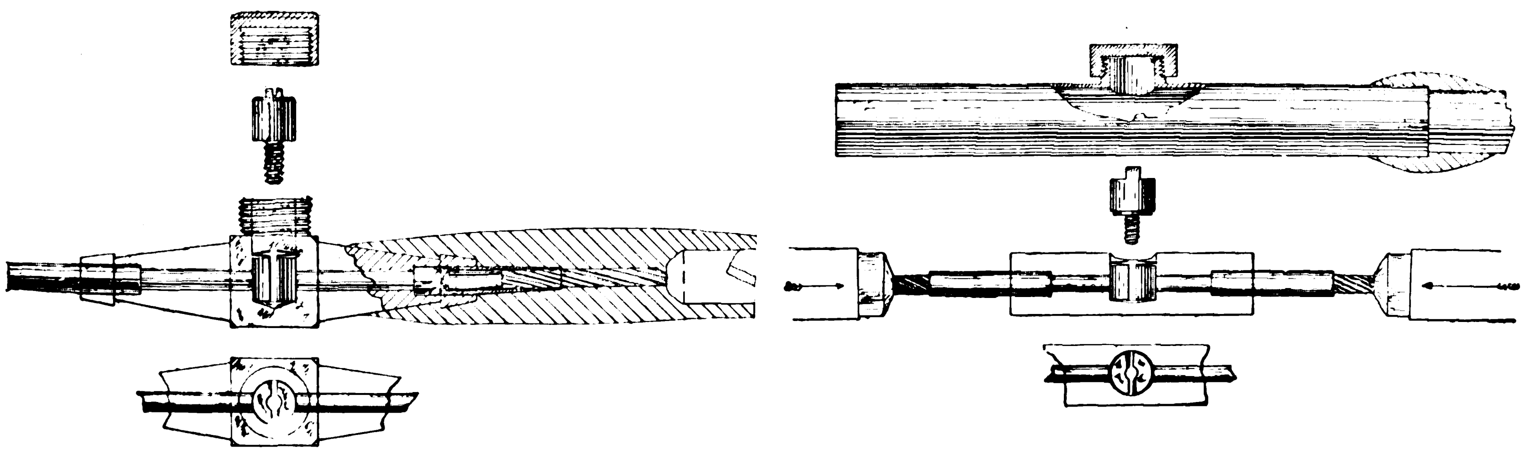
Figures were also obtained with these several bars under a compression of 226 kilos per square centimeter. (3,209 pounds per square inch.) These are plotted in broken lines from which it becomes apparent that for an induction of less than 16,000 lines, compression increases the resistance of the circuit so long as the bar is uncut, but when applied to the eight pieces, compression decidedly reduces the resistance of the circuit even when the magnetization is weak.

When applied to four pieces the increased conductivity of the joints due to compression just about neutralized the decreased conductivity of the iron due to compression.

It appears that in round numbers the resistance of each rough joint was nearly the same as that of a film of air, 0.005 centimeters thick, where there was no pressure and that this equivalent film was only reduced to about 0.004 centimeters, when a compressive stress was applied, which would have been intense enough to practically destroy the resistance of the joint, had the surfaces been carefully faced.

CONDUIT CONNECTOR.

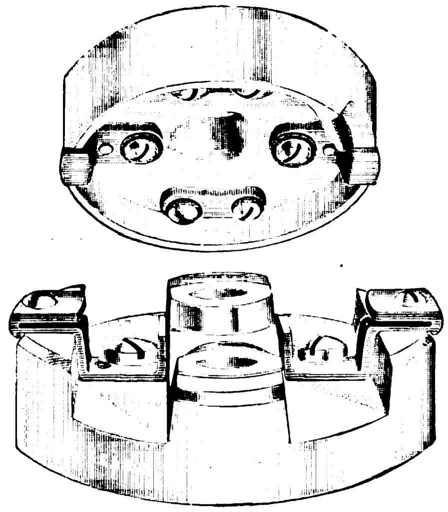
In the operation of underground electric circuits the problems connected with proper insulation and the location of faults are somewhat different from those met in overhead lines, and a number of devices have been brought out to solve them. Leakage in an underground cable is apt to be more serious than in an overhead line, and as the leakage resistance may be very high in proportion to the resistance of the conductor, the ground may be hard to locate. With an underground arc light circuit winding through many streets, it would be a difficult task to locate a fault without disconnecting different sections. To overcome this difficulty, George Cutter, of Chicago, has designed a conduit connector which makes it possible to separate the several sections quickly for testing by the simple removal of a screw plug. When this is replaced it forms a good connection and the joint is closed watertight. The cut shows two forms of this connector. The first has the metal terminals imbedded in a rubber shell, and a cap of the same material closes the opening. The ends of the cable are soldered into slotted sleeves and a heavy wrapping of rubber tape covers the joint. This form is used with rubber covered wires, while with lead cables the parts are placed in a brass sleeve which slips over the lead coating and is soldered to it. In either case the whole is sealed tightly and yet allows of easy disconnection. Connectors of this character are used on the underground arc light circuits operated by the City of Chicago.



CONDUIT CONNECTOR.

COMBINATION ROSETTE.

The combination ceiling rosette shown in the cut is so arranged that the branch wires to which it is connected can either pass directly through the slots shown in the base and make contact through the screws and the brass parts, as illustrated, when used with moulding or cleat work, or the branch wires may come through the holes in the center of the base and be attached to the screws in the contact pieces located in the slotted base. The rosette can be used under a variety of



COMBINATION ROSETTE.

conditions. It is put on the market by the Electric Engineering & Supply Company of Syracuse.

WHAT IS SAID OF "ELECTRICITY."

London Electrician.

In the first number there is certainly a judicious blending of every thing electrical.

Mechanical News.

The new paper is published from Chicago and New York, and is very handsome in its general design and make-up. We believe with the publishers of the new journal, that an electrical paper should have a popular side, and that it should contain matter of a practical character, as well as articles of a purely technical nature. Continued on these lines we doubt not that ELECTRICITY will meet with popular favor.

New York Recorder.

Its first number, of date July 22, is filled with interesting articles handsomely illustrated, which bear out the declared purpose of the publishers to furnish a publication that shall present the practical as well as the purely technical side of this science. This will, no doubt, prove of much value to a large proportion of the people engaged in electrical work and who have not sufficient scientific education to follow that exclusive side of the question. ELECTRICITY is tastefully made up, well edited and presents every evidence of possessing staying qualities.

The Phonogram.

Its illustrations are brilliant and beautiful. Being published in Chicago, it is needless to say that the execution is of the best. The public is at once convinced that it will be both instructive and entertaining. We wish this interesting periodical full success and especially commend its purpose of preparing articles suitable to the popular taste outside of scientific circles.

QUEEN'S NEW LABORATORY PHOTOMETER.

In the issue of ELECTRICITY of Aug. 26th there appeared a description of a very useful and cheaply constructed photometer. In laboratories where greater precision and refinement in determinations are aimed at, more carefully constructed instruments are required. Such a one is that especially designed for the comparison of electric lights by Mr. Elmer G. Willyoung and manufactured by Queen & Co., of Philadelphia.

The photometer is of the usual Bunsen type. Two tables, each 4 feet long by 20 inches wide, support the graduated bar and accessory pieces. These tables are of white wood, with ebonized top, and can be firmly screwed to the floor; the table legs unscrew so that the whole apparatus can be packed in comparatively small compass for transportation or storage. The bar is of metal, supported by a larger one of wood; the graduated bar is made in several different lengths and either graduated directly in candle power or in half centimeters. The wooden bar is made with a cross rail along the bottom, along which rides the carriage containing the Bunsen disc, or "grease spot." This carriage is arranged so as to rotate through 180 degrees about a vertical axis, thus allowing measurements to be made with each eye alternately toward each light, and hence, taking the mean of observation, eliminating largely the errors due to differences of vision between the eyes.

As a standard may be used a candle balance, a Methven screen, or an incandescent lamp, as preferred. The left hand table (Fig. 1.) is provided with cross rails parallel to the width of the table. The candle balance is mounted upon a base fitted to these rails and when drawn forward to the limit of the rails, is in correct position for use as a standard. Pushing the balance back out of the way, brass bed plates are disclosed upon which the Methven screen, or standard incandescent lamp (held by a special socket), may be placed and firmly fixed by means of two milled head screws. The right hand table (Fig. 2) is also provided with bed plates in such a way that the universal socket, the Methven, or the standard incandescent lamp may be placed in position, and the light measured by comparison with any of the other standards; hence the checking of the standards, or the standardizing of the standard incandescent lamp, can be very easily and quickly done.

The candle balance, seen more in detail (Fig. 3) has been arranged for weighing candles while burning. The bar of the balance is graduated in half grain divisions and differences of weight can be read off, by means of the rider, up to 50 grains. Equilibrium is secured by means of a counterpoise weight sliding along a rod beneath the balance beam; the rod itself is threaded at one end so as to be used as a micrometer adjustment when the counterpoise weight is fastened by means of the check screw. Either one or two candles may be used as desired. The balance also has an adjustment in its own length for bringing the line passing through the centers of the candle flames exactly at the zero of the scale.

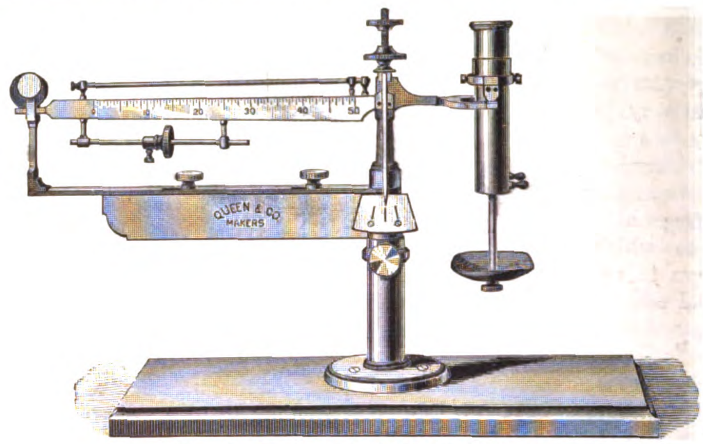


FIG. 3 —LABORATORY PHOTOMETER.

For holding the incandescent lamp to be measured the universal socket, shown in Fig. 4, has been devised. This socket consists, essentially, of a lamp socket with its central axis perpendicular to a graduated circle (The graduation is not shown in the cut). It can be rotated about this vertical axis and clamped in any position; the amount of rotation is measured by means of an index attached to the socket. A small set screw allows the index to be set at zero when the plane of the carbon filament is at right angles to the table length. The socket as a whole can also be rotated about a horizontal axis cutting the line passing through the center of sight box and center of illumination of the standard; the amount of rotation is read here also by means of an index and graduated circle. In order to bring the axis of greatest illumination of the lamp into the axis passing through the center of sight box, the frame

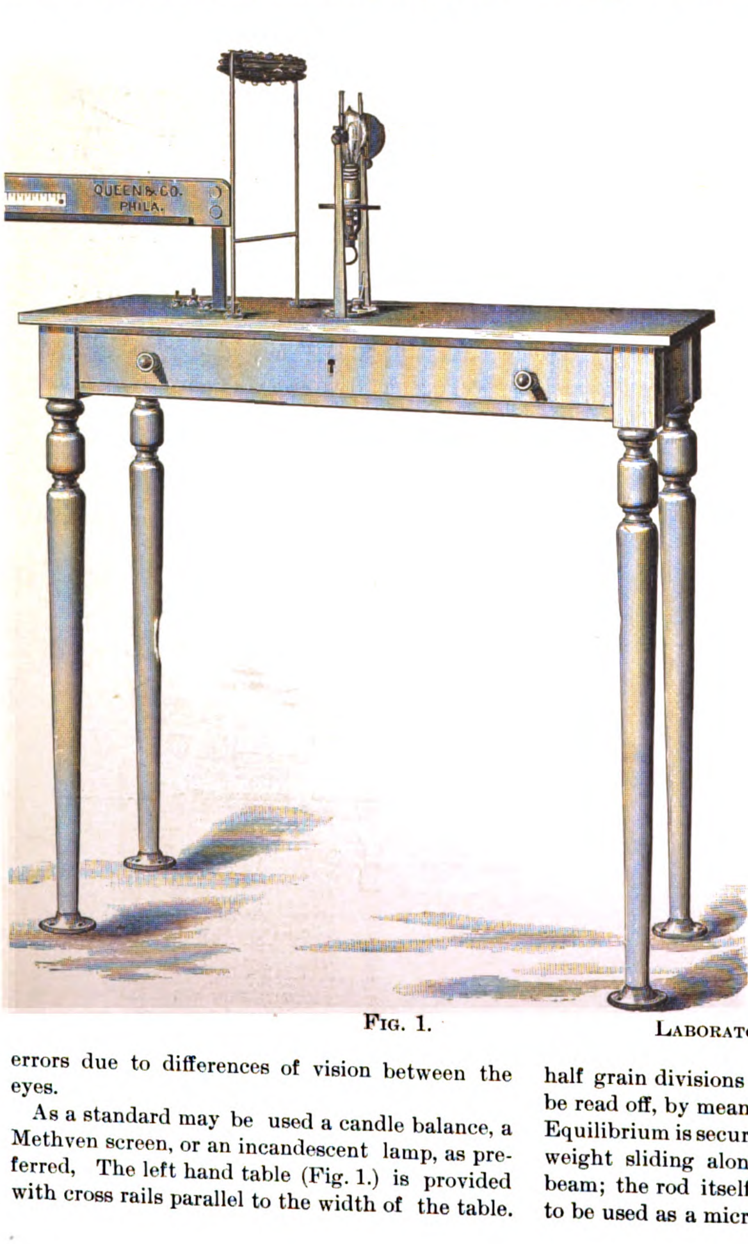


FIG. 1.

LABORATORY PHOTOMETER.

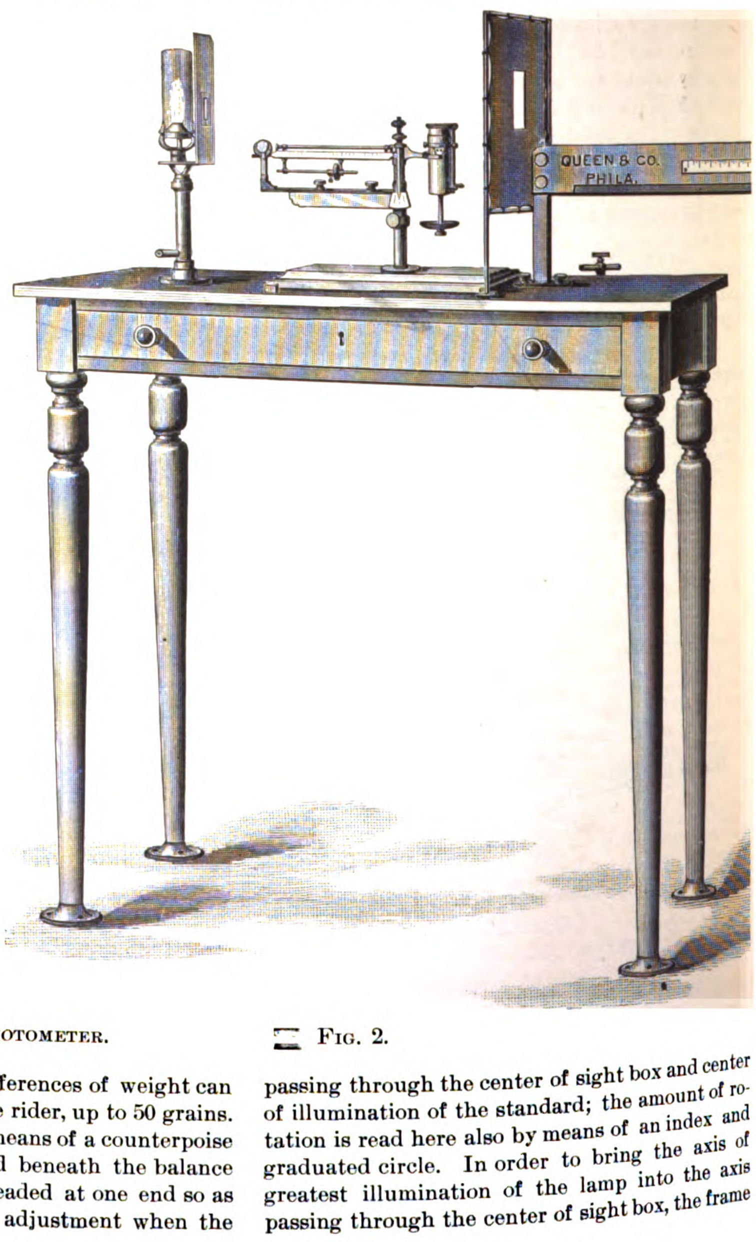


FIG. 2.

supporting the socket proper may be raised or lowered to whatever point desirable and there fastened. With the universal socket as with the candle balance there is a small adjustment in the length of the table thus allowing the axis of greatest illumination to be placed exactly at the end of the scale. Both circles are graduated to every

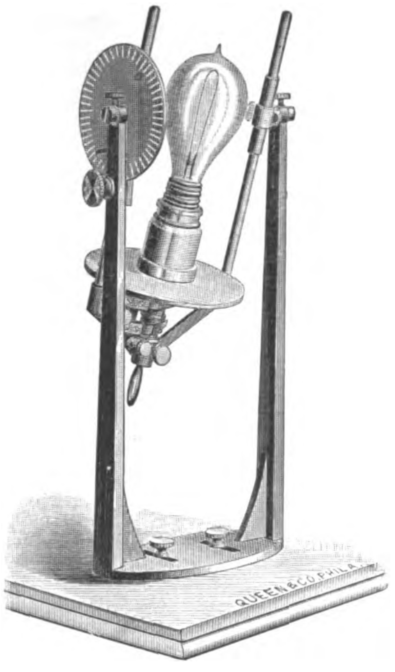


Fig. 4. Laboratory Photometer.

five degrees. The standard incandescent socket, not shown in the cut, is designed to hold an incandescent lamp to be used as a standard; as before stated this lamp socket may be placed upon the right hand table and its candle power measured by comparison with either the candle balance or the Methven screen; it may then be placed upon the left hand table and used as a standard, thus making both the standard and lights measured of the same color, and hence greatly facilitating observations. Curtains are provided for excluding extraneous light. All metal parts are finished dead black.

It is intended, as time permits, to adapt to this photometer several different accessories for use in taking measurements according to different methods, as e. g. Prof. Nichols' spectro-photometric method, the method of Lommer & Brodhun recently described, etc. It is expected also, to adapt the photometer to arc light measurements by adding certain accessory pieces.

REPLY TO H. WARD LEONARD.

Editor Electricity:—

In your issue of September 2nd, I find an article on "Minimum First Cost of Plant and Maximum Economy of Operation in the Electrical Transmission of Power," by H. Ward Leonard. In this article Mr. Leonard takes issue with me on this subject as published in two of the chapters of the "Electric Transmission Hand-Book."

Mr. Leonard commences his article as follows:

> A great deal has been and is being written and said about the condition governing the minimum first cost of a plant for the transmission of power by electricity, and also about the conditions governing the maximum economy of operation of such a plant, and some radical errors and false deductions have been made by those who are considered authorities upon this subject, so that it is not surprising that a somewhat erroneous idea at present exists in the mind of the electrical public upon this question.

My authorities to which Mr. Leonard refers are F. J. Sprague, Sir Wm. Thomson, Gisbert Kapp and Professors Ayrton and Perry. Mr. Leonard's statement is, to use Chicago vernacular, "very tough" on these illustrious gentlemen, and the little side attacks on myself can, of course, be borne easily in so good company.

It seems to be evident (at least in Mr. Leonard's mind) that there is only one electrical engineer who has correct ideas on this subject. I beg to draw general attention to a paper called the "Comparative Value of the Continuous and the Alternating Current Systems for the Commercial Distribution of Electricity," by H. Ward Leonard, read before the Chicago Electric Club in March, 1888. Mr. Leonard was then the champion of continuous current distribution from central stations, and he winds up his paper with the following paragraph:

> From the foregoing comparisons, I consider the alternating current is not applicable to central station lighting, as it is at present operated, except as a possible occasional adjunct, or else upon an extremely small scale in cases where a few lights very greatly scattered are required, and where power is cheap. In cases where cheap power exists at a distance of several miles from a town capable of supporting a station of 2,000 lamps and upwards, high initial e. m. f. becomes both desirable and necessary, but the continuous current convertor, which already exists in several forms, and which is receiving the attention of the best electricians and inventors of the world, will, in my opinion, be the device to supply this demand, and that very shortly.

It is unnecessary for me to point out how far Mr. Leonard's tables and diagrams and final conclusions were off the mark, as events during the last three years have proven that I was correct and Mr. Leonard mistaken. As an example I state the fact that the Thomson-Houston Electric Company alone, who have been manufacturing both direct and alternate incandescent systems, had, in 1887, 11,275 incandescent lamps on the direct current system in operation and none on the alternate; while by January 1, 1891, 108 companies were using the T.-H. direct current incandescent systems with 79,905 lamps, and 415 companies the T.-H. alternate current system with 435,550 lamps.

In view of these figures it might seem that indeed "some radical errors and false deductions have been made by those who are considered authorities upon electrical subjects," and "that it is not surprising that a somewhat erroneous idea at that time existed in the minds of the electrical public upon certain questions."

Mr. Leonard also calls my unpretentious little volume a compilation, while in the same paragraph he states that I deduced certain formulæ in my own original, but in Mr. Leonard's opinion, incorrect manner; that these formulæ, however, when properly interpreted are entirely correct. It seems to me that Mr. Leonard's own statements prove that my deductions, and therefore the results, namely, certain formulæ, are original, and not as he claims, copies of his own formulæ.

It is also most surprising to me that Mr. Leonard should have remained quiet "on the vital errors in some of the most noteworthy papers" and that such a "compilation" should arouse him to an answer.

Another surprising fact is that while Mr. Leonard writes about ten columns on the question of Minimum First cost of Plant, he writes only half a column on Maximum Economy of Operation, although this latter question in my opinion is by far the more important one.

Kapp's latest formulæ Mr. Leonard does not care to discuss as he had not seen Mr. Kapp's paper.

It would also appear that the last statement of his article "that under no circumstances would it be economical to lose more than 50 per cent. in the conductor," was some statement of his own, while as a matter of fact, this sentence appears in the Transmission Hand-Book and was taken from Gisbert Kapp's paper.

In quite a number of instances Mr. Leonard quotes me incorrectly and makes me responsible for certain statements which are put in the little book in quotation marks, thus indicating that they are quotations and not original statements.

As it is my desire to have this answer appear in your next issue, I shall confine myself for the present to these general remarks, but reserve the right to discuss in detail the merits of Mr. Leonard's paper at some future time. In the meantime I hope that "my authorities," especially Lieut. Sprague, will answer some of Mr. Leonard's statements, as the latter are not so much directed against me as against "the authorities."

You state in an editorial in your present issue:

> We print as a supplement this week a very valuable contribution from Mr. H. Ward Leonard, in which he derives formulæ, starting from an entirely different datum point, applicable to all the problems of minimum first cost and maximum economy, *which, by the way, he points out are not synonymous*, and shows where others have fallen into error in the discussion of the same questions. In this way he makes the issue between himself and them definite, so that should there be room for discussion it will certainly be forthcoming.

This may mislead many of your readers, as it was not he (Leonard) but myself who pointed out that "minimum first cost and maximum economy are not synonymous," as you can easily see by perusing the first paragraph of chapter VI. of the Transmission Hand Book. Yours, very truly,

F. B. Badt.

Chicago, September 3, 1891.

ELECTRICAL NOVELTIES.

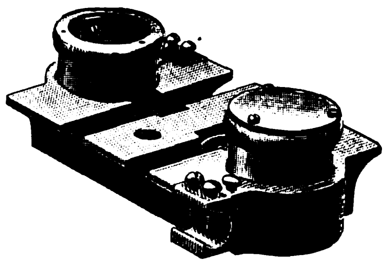


Fig. 1. Fuse Block.

The accompanying cuts represent several devices recently brought out by the Consolidated Electric Manufacturing Company, of Boston.

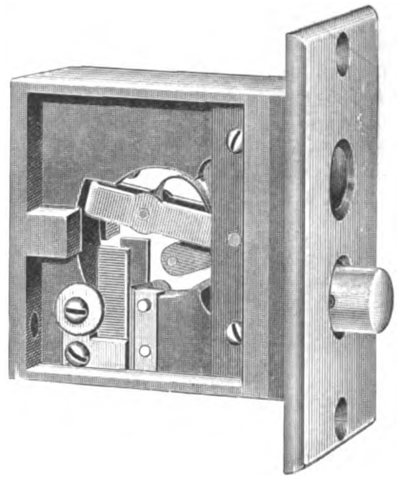


Fig. 2. Push Switch.

Fig. 1 is the Fay fuse block. As will be seen from the cut, the fuse cup can be detached from the base without removing any wire whatever, so that a new fuse may be inserted when the one in use

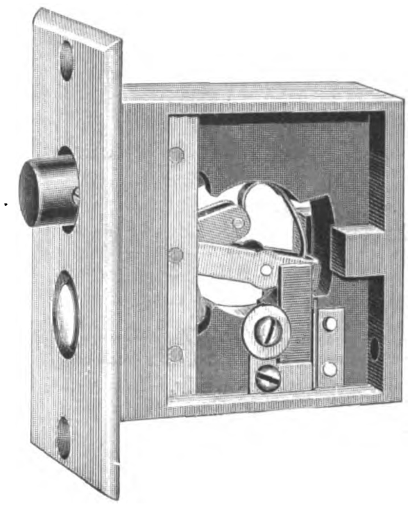


Fig. 3. Push Switch.

has been blown. This device is strongly made in porcelain.

Figs. 2 and 3 represent the C & C push switch, which is so constructed that it can be inserted in-

Fig. 4. Cylinder Battery.

to walls flush with the surface and it is possible at all times to ascertain with ease whether the current is on or off by a glance at the switch itself.

As will be seen from the cuts there are two buttons, the white one lighting the lamp, the black one extinguishing it.

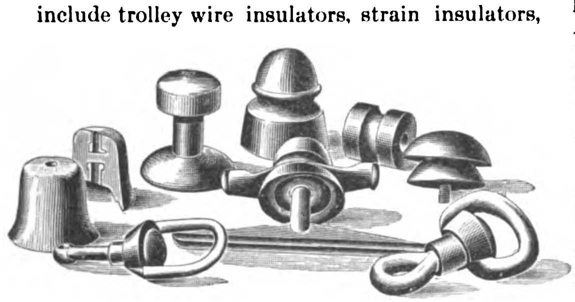
Fig. 4 is the Gem cylinder battery, recently brought out by this company for use in bell, annunciator and similar service. The carbon material is very porous and the battery it is claimed to be unusually efficacient.

NEW STREET CAR SYSTEM.

The report comes from Washington that a new street car system has been devised by a resident of that city which "will banish the trolley as well as the horse, and carry discomfiture into the camps of the capitalists who have invested millions in cable machinery." This is the description which will not "carry discomfiture" into the camps of electric railway men: "The steam engine, the most faithful servant and helper of man, is the agency which this inventor proposes to utilize in his new motor. Two pair of minute engines are to be placed in a box under each car. They will be fed from four steel reservoirs of hot water—water superheated to 400 or 500 degrees."

RAILWAY INSULATING DEVICES.

The accompanying cut shows quite an assortment of electric railway insulating devices, which include trolley wire insulators, strain insulators,



Insulating Devices for Electric Railways.

pull-offs, pole insulators, center curve insulators, terminals, etc. These goods are moulded in a new substance called the Ætna insulating material, which is susceptible of a high finish. The material is not affected, it is claimed, by heat or cold. The devices are introduced by A. & J. M. Anderson, of Boston.

ELECTRIC PROPULSION

The New York *Times* has been so bitter in denunciation of the trolley system that one could readily believe it had lost faith in the electrical system of propulsion entirely. It is a satisfaction to note that such is not the case. It closes a recent editorial attack on the trolley by this hopeful paragraph: "This matter of electric propulsion has been making rapid progress, which leaves little doubt that it is destined to a development in the future of which we now have little conception. One thing is already demonstrated. It is entirely practicable on underground railroads, and competent experts declare that with its use a sustained speed of forty miles an hour can be attained. Our new system of rapid transit will afford an opportunity for its development which promises to be of vast value. The London experiment with the Greathead tunnel has removed all doubt as to its practicability and economy, so that there need be no hesitation about adopting it, and the scale upon which it can be used here will furnish the incentive to inventors and capitalists for making every possible improvement in its application, to render it more effective and more economical."

RULE OF THUMB.

We frequently hear and use the term "Rule of Thumb," but would be at a loss, if called upon to do so, to give the rule in words. We have recently come across the rule which we advise our readers to read but not to use. Here it is: "You lift up a foot rule, place your thumb at zero and move it along inch by inch until you think it time to stop"—a process known as "thinking what to do" by some of the members of the engineering trade.

FROM NEWS CENTERS.

NEW YORK.

New York, Sept. 1.—The New York *Herald* has been winning golden opinions from the newspaper press all over the country on its enterprise in supplying prompt and detailed information on military operations in Chili. The long dispatches published by the *Herald* have really been the only trustworthy accounts of the Chilian insurrection published in the English language. It is interesting to note that these dispatches have been sent entirely over a system of submarine cables owned by an American company. The Mexican Telegraph Company inaugurated the chain of cable communication which connects the United States with the Central and South American republics, by laying cables between Galveston and Goatzacolcos, in Mexico. This work was completed in 1881. In the following year the Central and South American Company built a land line across the isthmus of Tehuantepec, and from the west coast of Mexico laid cables skirting the coast as far down as Callao, the principal seaport of Peru. Early in this year the company extended their system to Chili by laying cables from Callao to Iquique, and from Iquique to Valparaiso. It is over this extensive system of cables, which in length amounts probably to over 6,000 miles, that the *Herald* reports of affairs in Chili have been transmitted. All the cables are worked by English speaking operators, either Englishmen or Americans, and the *Herald* speaks very highly of the thorough manner in which these officials have carried out their work, laying special stress on the rapidity and accuracy with which messages have been forwarded, although, owing to the disturbed state of affairs the work has naturally been done under the most adverse conditions.

The accident on the South Brooklyn electrical line last week, when a train, composed of one motor and two passenger cars, ran into a brewer's dray, and injured three persons more or less seriously, points to the necessity of such perfect regulation of the speed of the surface car that no possibility of its getting beyond control shall exist. One of the strongest points in favor of the electric car is that it is eminently controllable, and anything that tends to engender doubt as to this essential advantage brings disrepute on the systems and gives the opponents of electric traction a good handle for their complaints. The accident, happily, did not result fatally, but, nevertheless, it was a most unfortunate occurrence, since electric railways are only just now beginning to be put into operation in the vicinity of New York, where such an immense field for them exists, and anything calculated to prejudice the mind of the public against them is greatly to be deplored.

The Rapid Transit commissioners met this afternoon, but practically, nothing was done. It was hoped that in view of the proposed adoption of the Greathead system for passenger traffic in Paris that something might have transpired to indicate that the commissioners were once more disposed to look favorably on the deep tunnel electric road which, early in their deliberations, they regarded as the system best adapted to the requirements of this city, but no such indication was given. The commissioners contented themselves with examining into various details connected with the work in hand, and stated that they were not yet prepared to make anything public. It is understood that the commission is now awaiting the reports of four expert engineers, on the presentation of which it hopes to be able to decide whether the roads shall be built on the "double-deck" plan, or whether they will consist of four parallel tracks on a level.

It begins to look as if the installation of the long-talked-of electric railroad for Staten Island will shortly be a reality. Erastus Wiman has been even more forcible and persuasive than usual while expatiating before the boards of supervisors on the growing importance of the island, and the strong temptation that a good electric road would offer to the adjacent city man to avail himself of its many residential attractions, and at last his energy is bearing fruit. At a recent meeting the supervisors were on the point of granting a franchise for the road, and only refrained from doing so because it struck them that they ought to know how an electric railroad is operated and constructed first. Mr. Wiman at once acceded to their request and extended an invitation to the various boards of supervisors and trustees in the different towns to go to Boston, and make an inspection of the West End Electric Road. The invitation was accepted, and the party is to start on Friday morning in a special car, and to return to Staten Island on Sunday. It is to be hoped that the visit will be so entirely successful that arrangements will be made for the immediate building of the Staten Island electric road.

G. H. G.

SAN FRANCISCO.

San Francisco, August 28.—The war between the cable railway company of Los Angeles and the Consolidated Electric Railway Company of the same place has reached this city, and is being waged with great bitterness. Rumor has it that before the conflict between these two giant companies is settled other like concerns will be drawn into the affair in defense of their own interests. The electric road people maintain that the cable road companies have become alarmed at their immense success, and are combining to impair their credit and cloud their contracts for work, which have been let in such numbers of late. The situation in Los Angeles, where the trouble started, is peculiar. The cable company there has enjoyed a monopoly in passenger traffic for several years. The road, however, has not yet discharged all its indebtedness to the Pacific Rolling Mills Company of this city, which had the contract for the iron work. Something like $50,000 is still owed on a debt of nearly a million dollars. Recently some enterprising capitalists obtained franchises to build an electric railway in Los Angeles. The new road parallels the cable road in many places, and this created a good deal of bitter feeling. When the Pacific Rolling Mills Company was given the contract for furnishing the iron work for the new concern hostilities began, and charges were openly made that the Rolling Mills people were backing the electric road with a view to ruining the cable company and getting $3,000,000 worth of property for less than $1,000,000. Creditors of the cable company grew alarmed, and suit was commenced to foreclose the second mortgage on the plant, involving some $1,664,000, with accrued interest. A receiver was appointed, and he is working to bring the cable road out with a satisfactory showing. At present the Rolling Mills hold the key to the situation. Both companies are in debt to it: the cable company for some fifty odd thousand dollars, and the electric company for several hundred thousand dollars. A joint conference of the directors and officers of the two systems is set for next week. The members are now on their way here to attend it. George H. Whittell, a director of the Rolling Mills, says that there is a chance for the cancellation of their contract with the electric company, providing a satisfactory agreement can be made for the payment of the money due it or for the assumption of the debt by responsible parties. Those in the fight admit that unless it is amicably adjusted one of the companies must go under in a very short time. Suit is now pending here against the President and Secretary of the Los Angeles Electric Road for $37,000 worth of electric apparatus furnished by the Edison company.

To add to the complications between the electric road and cable companies the San Francisco and San Mateo Electric Railroad, which holds franchises for forty miles of road in and south of the city, has suddenly stopped work on its line. A rumor says that the Rolling Mills Company, the stock of which is largely owned by cable line men, contemplates withdrawing from its contract with the Electric Company to furnish the iron materials, but J. W. Hartzell, general manager of the electric road, declares that the cessation of work is only temporary and that the Rolling Mills Company has given him every assurance that the materials will be promptly furnished in a short time and that no more delays will occur. Despite the active war between the electric road and the cable companies the boom in the building of the former lines continues. A large number of prominent citizens appeared before the Board of Supervisors of San Jose on the 24th inst., and urged the granting of a franchise for the electric railway from Haywards to that city. If the contemplated roads are built San Jose will have an electric road reaching it along each side of San Francisco Bay.

California Electric Light stock took a tumble on the 24th inst., from $13⅞ to $12¼ per share on the announcement of the levying of an assessment of $2 per share. Until quite recently the company has been paying a dividend of 15 cents per share each month. It has a debt of nearly $100,000, however, and it is necessary to settle this before making the proposed consolidation with the Edison people.

The Stockton street railway plant (horse cars) has just been sold to San Francisco capitalists. They will build and operate a complete electric motor system throughout Stockton.

O. B.

Henry R. Worthington's offer to furnish pumps with a capacity of 40,000,000 gallons of water daily for the World's Fair free, has been accepted by Chief Burnham. The water will be utilized for fountains, fire purposes, etc.

INCORPORATIONS.

The following new companies have been incorporated:

Mascoutah Electric Light Company, Mascoutah, Ill; capital stock, $5,000; promoters, Geo. Postel, Fred. Dilg, E. P. Hagist.

Electrical Engineering Company, Chicago; capital stock, $50,000; promoters, Richard H. Pierce, Geo. W. Seymour, Frank K. Biggs.

Oklahoma Water and Light Company, Chicago, Ill.; capital stock, $300,000; promoters, Chas. B. Wood, Horace S. Oakley, J. Gibson.

McCook Electric Light Company, McCook, Neb.; capital stock, $30,000: promoters, Frank Canuth, S. W. Huddleston, Geo. Hukhell, A. Campbell, McCook, Neb.

Enterprise Electric Light and Railway Company, Kankakee, Ill; capital stock, $100,000; promoters, August D. Ehrich, Thos. H. Magruder and Wm. A. McGillis.

The Paxton Electric Company, Paxton, Ill.; capital stock, $24,000; to furnish electric light and power; promoters, C. H. Langford, H. B. Henderson, J. L. Larkin.

The Imperial Electric Company, Camden, N. J.; capital stock, $25,000; promoters, J. S. Spruance, J. C. Dorphley, both of Camden, N. J., and J. Mustard, Philadelphia, Pa.

The Ford & Washburn Electric Company, Cleveland, Ohio; capital stock, $200,000; manufacturing electrical instruments, machinery, cars, boats, engines, etc., propelled by electricity; promoters, Lester A. Cobb, Geo. A. Ford, Edward S. Ford, Geo. A. Washburn, and Geo. Hoyt.

POWER.

The electric cars on the Pittsburgh and Birmingham electric road are to be fitted up with air brakes.

The people of Bucyrus, O., are discussing whether a road from that city to Galion would be a profitable venture.

At a special meeting of the St. Cloud, Minn., city council, permission was given the street car company to use electricity as a motive power.

Marseilles, France, has decided to adopt the overhead electric system for street car propulsion, and a new street car line, for which a franchise was recently obtained, will be built. The plant will be the first electric installation of its kind in a large city in France.

The route of the Negaunee and Ishpeming electric railroad, which is to be 4½ miles in length has been finally decided upon and part of the equipment ordered. It is expected to make the trip between the city halls of the two cities in fifteen to eighteen minutes.

The Jamestown Street Railway Company is operating one of the most successful street railways in the country, although the conditions under which the electric equipment is obliged to work are of the severest character. The road is a succession of grades running up to over 9 per cent. in several places, and many of the heaviest grades have also sharp curves. Short, double reduction motors are used. The management has placed three additional orders for equipment, and is unable to handle the traffic forced upon it by the success of electricity. The Short motors are called upon to do extremely heavy work, being obliged to propel an 18-foot vestibule car with a trail car up the heavy grades under all conditions of track and traffic.

The tendency of street railway companies to substitute electric cars for cable cars on their lines is on the increase, says an exchange, and the statistics of working expenses and assets which from time to time become available go to show in every case that the change has been a wise one. Another confirmation of the superiority of the electric car over the cable from a financial point of view is afforded in the statement of last year's earnings and expenses of the Denver Tramway Company, which shows that while the operating expenses to gross earnings of the cable lines in Denver stood in the ratio of 77 per cent., those of the electric lines were 55 per cent., a clear 20 per cent. in favor of electricity.

As already stated in ELECTRICITY the Love Electrical conduit system of street railway traction is about to be tried in Chicago. The route over which this new system is to be installed is the Fullerton avenue loop on the North Side and is about one and one half miles in length, including four curves and two railway crossings. Mr. Yerkes, the Chicago Street Railway magnate, who is anxious to test the efficiency of the patent, gives the right of way and pays the cost of the seventy-five pound rails which are to be laid. The Love Company has appropriated $200,000, it is said, for the purpose of making this demonstration of its patent. Contracts for the iron work have already been let and construction work will begin Oct. 10.

In the first half year of the operation of the City and South London Railway, 2,412,343 passengers were carried and 141,408 train miles were run. The receipts per train mile for this half year ending June 30, from all sources, were 66 cents, against the Metropolitan Company's average of 84 cents. The number of passengers per train mile was 17 against 43 in the case of the Metropolitan. This is partly accounted for from the fact that on the latter line the cars are much larger than on the former. Receipts from all sources were £19,688, or $98,440, to which passengers contributed £19,403, or $97,015. The total expenses for the same period amounted to £15,520, or $77,600, leaving net £4,168, or $20,840. To pay 5 per cent. on the capital actually invested up to date would require about $100,000. The working expenses amount to over 78 per cent. of the gross receipts.

LIGHT.

Twelve thousand dollars has been subscribed by the citizens of Deposit, N. Y., for the purpose of erecting an electric light plant.

The capacity of the station of the People's Incandescent Electric Light, Heat & Power Company, of Meadville, Pa., is to be doubled.

The Rawlins, Wyoming, Electric Light Company has ordered an Edison plant. It is expected that the system will be in operation within ninety days.

The Brush Company, of Rochester, recently applied to the city authorities to lay an underground conduit. The petition was referred to the superintendent of telegraph, Charles R. Barnes. In his report to the executive board he says: "Any permission given for a permanent conduit should be for one of sufficient capacity to not only accommodate all the wires now in use, but provide for the future, and be accessible to all companies now using wires or companies which may be organized for that purpose in the future. In my judgment no company should be allowed permission to lay a conduit for its own wires exclusively, which would involve the laying of a multiplicity of conduits in the streets."

An interesting installation of the electrical transmission of power has just been inaugurated at St. Moritzbad, in the Engadine. The motive power is obtained from the Julier brook, which is situated near Silvaplana, about three miles distant from the lighting center. Instead of driving the turbines on the spot, the water is conveyed to them along an iron pipe 2ft. in diameter, and about 2300ft. in length. Throughout this length the main is enclosed, the total fall at the generating center being 610ft. Here are installed three turbines of 160-horse power each. These drive direct three Ganz alternators arranged in parallel, and having a total output of 240,000 watts. The regulation of the turbines is effected automatically, and the alternators are capable of feeding 4500 incandescent lamps of 16-candle power at the same time. From this generating station the current is transmitted at 3000 volts by overhead conductors carried on oil insulators fixed to wooden posts, to five transformer stations in St. Moritzbad. The 3000-volt current is there reduced to 100 volts and distributed throughout the town for the lighting of the hotels, restaurants and other places.

JOTTINGS.

The Danish Academy of Sciences recently offered the following among other prizes:—A gold medal, worth about £17, for an exposition of the theory of electric vibrations in limited and resting bodies in general, with a special application to simple forms of perfect conductors, so that for these cases the mathematical problem may be explained, and if possible solved.

An electrolytic meter of novel design has recently been devised by M. E. Grassot. It consists of a silver wire 5 millimeters in diameter placed in a glass tube and dipping into a solution of nitrate of silver. As the current passes, the silver goes into solution and is deposited upon the other electrode which is of zinc, and as it loses weight is made to descend and pull around a drum actuating a train of clock wheels and indicating dials.

The Societé d'Encouragement, of Paris, has offered a prize for 1893 of 3,000 francs, which will be awarded to any one discovering a substance partially, if not wholly, taking the place of gutta percha, or to any one who has made the most deserving contribution to the knowledge of the planting, acclimatization or improvements in the culture of the gutta percha tree. Another prize of 2,000 francs is to be given for the best apparatus or industrial method by means of which the insulation of the different parts of an electrical plant can be measured while the full current is on. Further particulars can be obtained from the secretary of the society, 44 Rue de Rennes, Paris, before Dec. 1st, 1892. Communications should be written, if possible, in French.

W. Barnet Le Van, has recently sent to the press an opinion relative to the explosions which occurred in the boiler in the Edison station in Philadelphia. He says: "When such artificial means are employed to stimulate the natural draft parts of the tubes or pipes of the boiler, are subjected to a greater degree of heat than other parts, resulting in the water confined in the tubes being driven from the overheated parts toward the cooler parts in opposite directions. This being so it results that when the fire is arrested by opening the furnace doors, the adding of fresh coal or otherwise the overheated parts are suddenly cooled, resulting in the instant rush towards such parts of the confined water, producing a sudden shock, or blow, termed a 'water hammer,' and that a rupture of the boiler should result is most natural."

PERSONAL NOTES.

George H. Flower, inventor of the present form of Detroit sight feed lubricator, is now electrician of the Fairhaven, Wash., Electric Light & Motor Company,

G. W. Angier, who has been purchasing agent of the Great Western Electric Supply Company, has accepted the position of assistant manager of the Knapp Electrical Works, Chicago.

M. D. Barr, Canadian district manager of the Edison General Electric Company; John Muir, general manager of the contracting department; S. Dana Greene, general manager of the sales department; Luther Stieringer, in charge of the exhibit, and M. J. Sullivan, advertising agent, will represent the Edison General Electric Company at the Montreal Convention.

COMMERCIAL PARAGRAPHS.

The New York Insulated Wire Co. has received through its western representative, G. H. Meeker, an order for supplying the Kansas City court house with Grimshaw wire.

The Crocker-Wheeler Electric Motor Company, New York, is having a large business. The company has just furnished a ½ h. p. motor for the new Chilian cruiser being fitted out in England.

The Rice & Whitacre Manufacturing Company, of 47 and 49 Canal street, Chicago, makes a specialty of the Russell engine. The company has lately received a number of good orders for this and other steam appliances.

The A. W. Harris Oil Company, 55 South Canal street, Chicago, in an interview recently said, "Three years ago our trade with electrical people was limited, but we find our orders in that direction steadily increasing.

The Consolidated Electric Manufacturing Company is now running its five story factory at 355 Congress street, Boston, at full time, to keep up with the demand for its many new and useful specialties which have been brought out since Mr. C. E. Bilsbee took charge as general manager.

The improved Root steam boiler is a favorite for electric light and power stations. It is safe, reliable and efficient, besides being economical in the use of fuel and durable. The manufacturers, Messrs. Abendroth & Root Manufacturing Company, New York, are doing a big business.

The transaction of office business may be wonderfully expedited and thoroughly systematized by the use of approved labor-saving devices. The superiority of the goods manufactured by the Office Specialty Company, Rochester, N. Y., is everywhere recognized.

The Knapp Electrical Works, of Chicago, are handling a large amount of safety rubber wire. Their factory, occupying the upper floors of their building, 54 Franklin street, is at present employing a large force of hands on annunciators, bells and other specialties which they manufacture.

The Electrical Supply Company, of Chicago, report an increasing demand for the new Wirt volt indicator and ampere indicator. The last order received was for six volt indicators from a Boston firm. This order was sent after a thorough test of a volt indicator sent on a previous order.

The Weston standard direct-reading volt-meters and ammeters are having a large sale. The Weston Electrical Instrument Company, of Newark, N. J., sole manufacturers are kept busy. Very nearly every large company manufacturing or selling electrical machinery has adopted these instruments as standard electrical measuring instruments.

The Interior Conduit and Insulation Company, of New York, will be represented at the Montreal Electric Light Convention by its president, Edw. H. Johnson, general manager, E. W. Little, and E. F. Greenfield, electrician. As usual, the company will present a complete exhibit of its system of electric wiring. This being the first opportunity presented, since it has embarked in the general electrical manufacturing business, to make an exhibit of new appliances and apparatus, it is promised that many novel devices will be shown. The Johnson Ampere Meter, a dead beat instrument, and the Johnson Vice-lock Switch will be found worthy of attention. The switch—the last invention of Mr. Johnson—will be found an extremely efficient device; the recent tests upon the first models have excited the interest of many prominent electricians. A neat circular relating to their switch will be distributed at the convention. The company promises to show the new California arc lamp which it is about to place upon the market. This lamp is only fifteen inches in length, has no obstruction underneath, consequently casting no shadows, and will burn, it is stated, over ninety hours without trimming or change of carbons. This new departure in arc lamps will be worthy of the special attention of those visiting the exhibition. The Garland carbon protector is another device that will be shown. This device, it is claimed, will be found especially useful in enabling the users of the single carbon type of lamp to enjoy all the advantages of continued use of carbons, hitherto accomplished by the use of double carbon lamps. It is claimed for the Garland carbon protector that it is effective in decreasing the consumption of the carbons from one inch and a half to one-half inch per hour. Other useful and novel appliances, especially applicable to the conduit system will be shown.

The Union Electric Works, of Chicago, will soon place on the market a new patent annunciator from which they expect large returns. They have recently finished an order for 5,000 of their new style bells, and have several other larger orders on their books. They report a good demand from bell-hangers for their line of goods.

W. B. Pearson returned from St. Paul last week, where he closed a contract with the Queen of the Hills Mining Company, of Neihart, Mont. The contract calls for a complete steam plant, including boilers, pumps, shafting, and a 400-horsepower Ball & Wood engine. When completed the plant is to be used to generate current to run electric mining drills.

The Electrical Supply Company, of Chicago, has just issued its catalogue, No. 44, descriptive of goods contained in its house goods department. The company says: "We believe that our stock includes the best of everything needed by the bell-hanger, telegrapher, student and those interested in district telegraph, messenger and fire-alarm systems." The catalogue is a volume of 150 pages, and is thoroughly illustrated.

The Ries Electric Specialty Company, of Baltimore, have recently secured the handsome and commodious building on the northeast corner of Baltimore and Eutaw streets, directly opposite the Eutaw House, and have just fitted it up with the necessary machinery and appliances for manufacturing some of their electrical specialties. The company have a number of novel devices which they propose to put on the market. One appliance they say will have the effect of greatly decreasing the cost of incandescent lighting. What its nature may be the company do not yet see fit to disclose.

Mention is frequently made of plants where electricity is generated by water power, but it is not common to see a plant where hydraulic pressure is produced by electricity. Nevertheless the time is not far distant when it will be common to force water to the upper stories of high buildings to be used for hydraulic elevators and other domestic purposes by electric motor. The manner in which this can be accomplished is clearly set forth in a well illustrated catalogue, issued by the Goulds Manufacturing Company, of Seneca Falls, N. Y. The first thirty pages of this catalogue are devoted to describing and illustrating the many different places in which the triplex electric pump, manufactured by this company, can be used to advantage. The remaining pages contain interesting tables of tests of motors and pumps for power, efficiency, etc. The catalogue will be found very interesting to any one looking up the subject of electric pumps, and should find a place in all engineers' catalogue libraries.

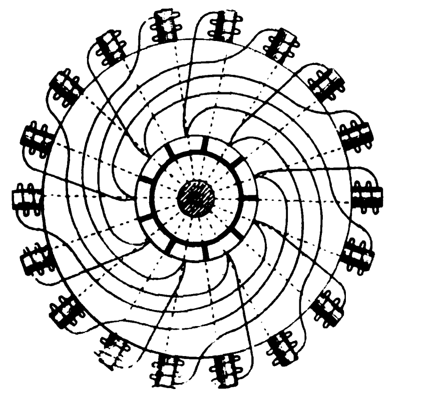
ELECTRICAL PATENT RECORD.

Letters Patent Issued Aug. 25, 1891.

DYNAMOS AND MOTORS.

458,162. Electric Motor. Ludwig Gutmann, Fort Wayne, Ind. Application filed Dec. 1, 1888.
This invention relates to an electric motor so constructed as to operate by the action of an alternating current.

458,164. Method of Operating Alternating Electric Motors. Ludwig Gutmann, Pittsburg, Pa. Application filed Feb. 4, 1890.



Patent No. 458,236 Armature.

The object of this invention is to provide an alternating current motor which will be self-starting, self-regulating within certain limits of load, and of such efficiency as to be applicable for practical use.

458,236. Armature for Dynamo-Electric Machines. Laurence A. McCarthy, Brooklyn, N. Y. Application filed Feb. 18, 1891.
The object of this invention is, by combination with the principles of the Siemens H-armature and the drum armature of Alteneck, to provide an armature for direct current motors of low resistance having as little useless wire as possible, and which, while being electrically efficient, will be simple in construction and can be repaired readily by removing faulty coils and replacing them with others.

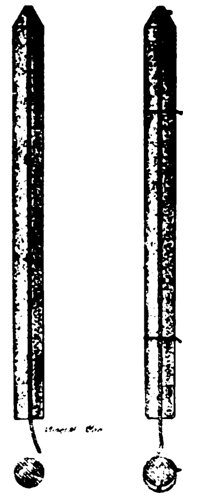
458,545. Electric Motor. Charles E. Egan, Columbus, O. Application filed Nov. 28, 1890.

RAILWAYS AND ACCESSORIES.

458,377. System of Electric Propulsion for Vehicles. Walter S. Richards, of Natick, Mass. Application filed Jan. 19, 1891.
Claim 1 reads: "The combination of a way or road, primary electric coils disposed in series along said way and connected with a dynamo or other source of electricity, a vehicle adapted to travel on said way, propelling mechanism on said vehicle, an electric motor on said vehicle for operating the propelling mechanism, and secondary coils on said vehicle connected with said motor and adapted to be inductively electrified by said primary coils."

458,427. Support for Trolley-Wires. John H. Palmer, of Boston, Mass. Application filed Dec. 19, 1890.

458,489. Electric Signal and Switch Moving Mechanism. Joseph Ramsey, Jr., Edward W. Harden and Charles Morris Wilder, of Cincinnati, Ohio. Application filed Feb. 5, 1891.
The object of this invention is to provide a device which can be operated by electricity to move a switch rail, signal or gate.



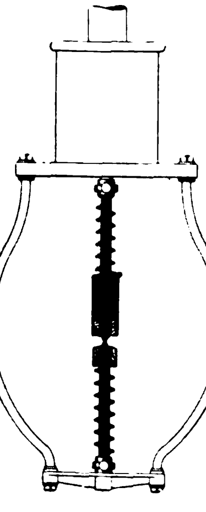
Patent No.—458,376 Arc Lamp Electrode.

LAMPS AND ACCESSORIES.

458,242. Electric Lamp Socket. Horace E. Swift, of Boston, Mass. Application filed March 23, 1891.

458,279. Portable Electric Lamp. Lars Bristol, of Bromley, Eng. Application filed Aug. 28, 1890.

458,376. Arc Lamp Electrode. Walter S. Richards, of Natick, Mass. Application filed Jan. 3, 1891.
This invention relates to carbon electrodes for arc lamps which are provided with capillary conductors of refractory material adapted to conduct a liquid hydrocarbon to the arc.



Patent No.—458,387 Arc Lamp.

458,386. Electric Arc Lamp. Nathan M. Garland, of New York, N. Y. Application filed Dec. 29, 1890.
Claim one reads: "An arc light having its upper carbon provided with a movable projecting cap or hood of refractory material of substantially the same internal diameter as the carbon, but shaped to bear against the coned end thereof and adapted to move in the direction of the support of the carbon as it burns away."

458,387. Electric Arc Lamps. Nathan M. Garland, of New York, N. Y. Application filed Dec. 29, 1890.
This invention is directed particularly to arc lights of the type in which two or more carbons are fed toward each other either by the action of gravity or through the medium of well known devices. It has for its object, first, an increased length of life of the carbon; second, the prevention of combustion thereof through the effect of air; third, the utilization of means which travel with the moving carbons as they are consumed for decreasing the resistance offered to the electrical current as it passes through the lamp; fourth, the diffusion of heat created at the arc, whereby a decrease in the general temperature of the entire lamp and of the space in its immediate vicinity is effected.

458,388. Electric Arc Lamp. Nathan M. Garland, New York, N. Y. Application filed Dec. 29, 1890.

458,389. Electric Arc Lamp. Nathan M. Garland, of Boston, Mass. Application filed May 18, 1891.

458,500. Electric Arc Lamp. Herman W. Sander, of St. Louis, Mo. Application filed Aug. 25, 1891.
This invention has for its object to produce an electric arc light in which the arc will always remain at a given point, and in which a larger amount of carbon is available than with the ordinary form of arc light.

METAL WORKING.

458,176. Art of Electric Welding. Herman Lemp, of Lynn, Mass. Application filed May 31, 1890.
This invention consists in covering the conducting blocks, clamps, or clamping surfaces, particularly at their working parts, and also the work pieces where clamped or connected, with film of liquid, such as water, whereby the metal is protected from the air, and can not, therefore, be coated with scale resulting from a combination of the oxygen of the air with the metal. The metal surfaces in contact and traversed by exceedingly heavy currents are cooled, and present their normal conducting power. The contact obtained is virtually improved or made better by the insertion of capillary films of the liquid between the surfaces almost in contact or separated only by microscopic spaces.

458,177. Adjustable Electric Clamp. Herman Lemp, Lynn, Mass. Application filed Oct. 9, 1890.

458,188. Electric Clamp. E. Rasmussen, of Lynn, Mass. Application filed Dec. 19, 1890.
The object of this invention is to provide means whereby the surfaces of clamps are protected from the abrasive action of work pieces.

CONDUCTORS AND INSULATORS.

458,551. Insulating Compound. James L. Marmaud, Malden, Mass. Application filed May 19, 1891.

458,221. Insulator. Murray C. Chase, Chicago, Ill. Application filed Nov. 14, 1890.
This invention relates to insulators, particularly such as are employed for supporting trolley wires at the points where they pass about curves.

458,316. Electric Conductor. Frederick E. Degenhardt, Chicago, Ill. Application filed Sept. 1, 1890.
The invention relates to certain improvements in the manufacture of electric conductors and cables, and has for its object a construction and arrangement of the protective covering of the conductors and cables, whereby provision is made for the retention of air or gas within the protective covering, thereby decreasing the static capacity.

TELEPHONY.

458,258. Spring-Jack Commutator for Telephone Switch Boards. Louis Alfred Berthon, Paris, France. Application filed August 25, 1891.

458,479. Telephone. Eloy Noriega, Mexico, Mexico. Application filed Feb. 4, 1891.

BATTERIES.

458,424. Secondary Battery. Oraxio Lugo, New York, N. Y. Application filed May 26, 1891.

458,425. Secondary Battery. Oraxio Lugo, New York, N. Y. Application filed May 26, 1891.
This invention consists of a relatively electro-positive metal or substance and a relatively electro-negative metal or substance, both coated with a suitable oxide, such as oxide of lead, and placed in a liquid, such as a solution of borax or ammonia, which will not act primarily upon either, but will act secondarily upon both.

MISCELLANEOUS.

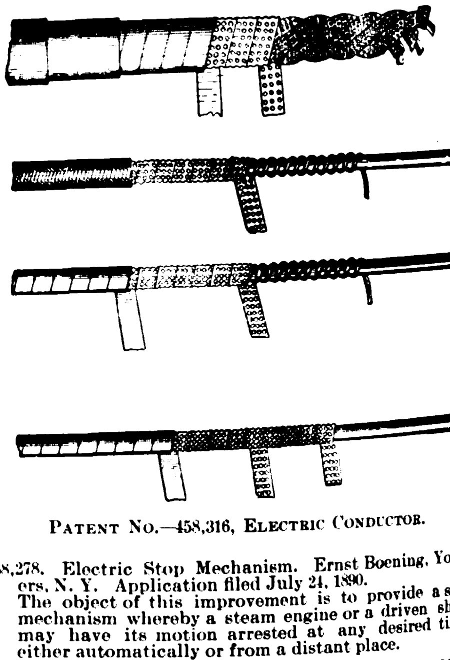
458,154. Automatic Gas Lighting Apparatus. George D. Clarke, Chicago, Ill. Application filed Dec. 30, 1890.
The object of this invention is to provide means whereby gas may be lighted and extinguished at such times as may be desired during the twenty-four hours.

458,163. Alternating Electric Current Heater. Ludwig Gutmann, Pittsburg, Pa. Application filed Dec. 9, 1889.

458,178. Electric Alarm Clock. Charles Lester, Chicago, Ill. Application filed April 10, 1891.

458,184. Electric Coal Mining Machine. Edmund C. Morgan, Chicago, Ill. Application filed Sept. 15, 1890.

458,206. Electric Alarm Clock. Louis Winterhalder, Brooklyn, N. Y. Application filed Dec. 4, 1890.



Patent No.—458,316, Electric Conductor.

458,278. Electric Stop Mechanism. Ernst Boening, Yonkers, N. Y. Application filed July 24, 1890.
The object of this improvement is to provide a stop mechanism whereby a steam engine or a driven shaft may have its motion arrested at any desired time, either automatically or from a distant place.

458,343. Circuit Closer. Percival D. Richards, West Medford, Mass. Application filed March 30, 1891.
The object of this invention is to provide a circuit-closer of simple construction fitted to be grasped by the hand.

458,372. Electric Alarm Clock. James O. Newton, New Haven, Conn. Application filed May 25, 1891.

458,396. Cut-Out. William F. Irish, New York, N. Y. Application filed Sept. 15, 1890.

458,486. Electric Gas Lighter. Horace A. Pinkham, Philadelphia, Pa. Application filed Oct. 25, 1890.

458,536. Electric Uterine Supporter. George F. Mohn, Los Angeles, Cal. Application filed March 26, 1891.

ELECTRICITY.

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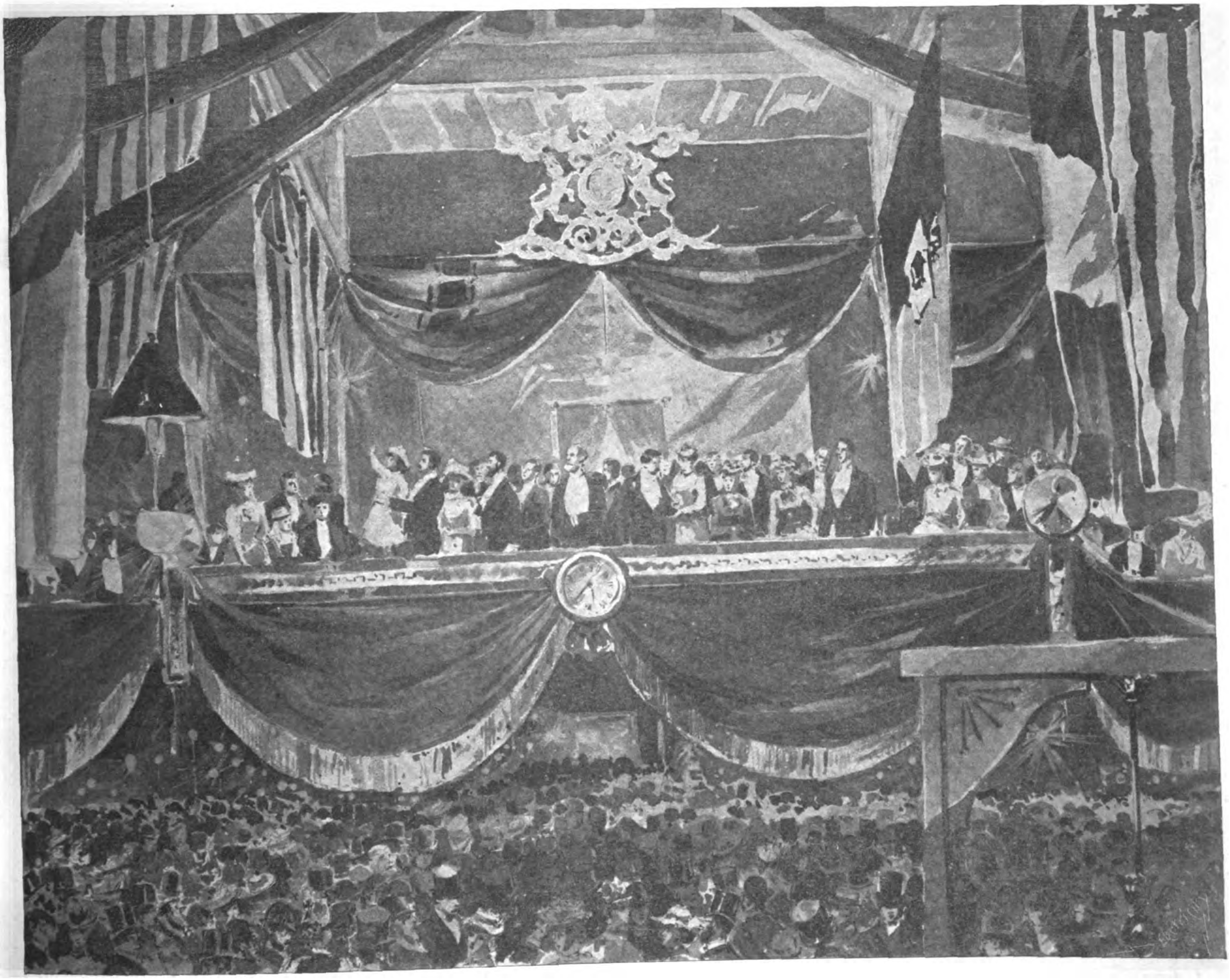


OPENING OF THE ELECTRICAL EXPOSITION AT VICTORIA RINK, MONTREAL.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

FOURTEENTH CONVENTION AT MONTREAL.—REPORT OF THE PROCEEDINGS.

The fourteenth convention of the National Electric Light Association, at Montreal, was in many respects, the most novel and most interesting meeting in the history of the organization. The residents of the city realized that a very handsome compliment had been paid them, when the association, although styling itself National, declined invitations from several cities in the United States, and voted in favor of the metropolis of Quebec. To show their appreciation of the compliment, the citizens formed a committee and, under the leadership of A. J. Corriveau and Prof. H. T. Bovey, they planned an elaborate programme for the entertainment of the visitors. It was at first feared that Montreal would seem so far distant that the attendance would be small, but that fear was dispelled on the day previousto the opening of the convention. The New York special train drew into the city with 160 passengers. Delegates besides came from all directions and a score of Chicagoans took the thirty-six-hour journey to the city. The headquarters of the association were at the Windsor Hotel, and this roomy structure was constantly thronged with those interested in the meeting. The committee arranged the most elaborate exhibit ever seen at a convention, and this, too, in spite of the fact that United States companies naturally hesitated about sending their apparatus across the line. Considered from every point of view, the convention was successful, and every visitor left with a high opinion of Canadian hospitality.

THE FIRST SESSION.

The first session of the convention was held in the Assembly Hall in the Windsor Hotel, on Monday afternoon. The officers of the association, representatives of the city government, and a number of prominent residents of Montreal occupied seats on the platform. President C. R. Huntley, of Buffalo, called the meeting to order and asked Prof. H. T. Bovey, chairman of the Citizens' Committee, to take charge of the opening exercises. The latter welcomed the members of the association to the city and introduced Mayor McShane, who said that as the representative of the citizens of Montreal he wished to extend a hearty welcome and assure the delegates that the residents of the city were anxious to do all in their power to make the visitors' stay agreeable. Sir Donald A. Smith followed, with an address of welcome, after which Sir J. W. Dawson, principal of McGill University, as representative of Canadian educational institutions, expressed his satisfaction that the association was meeting in Montreal. He said:

"I recognize what all our universities and colleges are bound to recognize, that in the presence of an association like this, we are in the presence of the representatives of a great, growing and coming profession, and one which perhaps more than any other, has served to bring to the notice of the world the great advantages that may arise from the prosecution of the physical sciences."

Alderman Clendenning, ex-Mayor Beaugrand, Alderman Cunningham, and Richard White followed with brief addresses in the same general strain.

President Huntley resumed the chair and after expressing his appreciation of the addresses of cordial welcome, called upon United States Consul Knapp for an address. The latter congratulated the association on having so royal a host as the city of Montreal, and felicitated the city on the opportunity of entertaining such interesting visitors.

Judge Armstrong, of Camden, N. J., the next speaker, in referring to the community of interest and feeling between the people of Canada and the United States, as shown by the hearty welcome tendered to the association, illustrated his remarks very happily by an allusion to the badge of the Convention in which were two flags, representative of distinct states, and yet meeting at a common center. Electricity, he said, was a common point of contact around which distinctions of people and government were merged for the good of humanity.

ADDRESS BY ERASTUS WIMAN.

Erastus Wiman, of Staten Island, who was next called upon, said he had peculiar pleasure in addressing the assemblage, in that he appeared before them in a double capacity; first, as a member of the National Electric Light Association, and as such to return his thanks for the hospitality extended by the city, and secondly, as a Canadian, to thank the electrical fraternity for affording his native land an opportunity of welcoming a body of men so representative of the great growth of science, men who had been so intimately connected with the marvelous achievements in electricity of to-day. Of these achievements Canada had a keener appreciation even than America herself. In telephones, for instance, he questioned whether any greater development could be found anywhere in the United States, or even in the world, than could be seen in Montreal and Toronto, which had ideal systems, and the telegraph service of Canada involved a larger mileage of wire, a greater number of offices, and the transmission of a larger number of messages in proportion to the population than any other country.

Beyond this a cheaper transmission was uniformly afforded in the Dominion than any other land, taking distance into consideration; so that, in both telephony and telegraphy electricity had found its greatest development in Canada. There were some respects, however, in which the United States was ahead and one of these was in electric street railway work. One of the most suggestive points in connection with the phenomenal development which had taken place in this direction was the rapid increase in the value of real estate wherever an electric railway had been introduced. The power to create wealth in the United States was regarded as almost limitless. The country produced last year eight million bales of cotton, which had sold for \$400,000,000 a sum greater than the production of all the gold mines of the world in five years. It had turned out ten million tons of iron for the year, and this year the crop of wheat would be unprecedented. Yet all these great accumulations of wealth sank into insignificance compared with the increased value in real estate wherever an electric railway was promoted. He need only instance the case of Boston, of Minneapolis and St. Paul, of Tacoma and of Spokane. In Montreal, of all cities, was this fact only beginning to be realized. Great as were the possibilities of electric propulsion in this country, still more marvelous were those of the electric transmission of power. Here the opportunities of Canada eclipsed those of any land on the face of the globe in potentiality. With the great Rapids above them and below them the people of Montreal had within their grasp the ability to call to their bidding a mighty and a subtle power, a power that could be brought under such perfect command that it would with equal facility wield a trip hammer or rock a cradle. All that the country wanted was stimulation, and he could conceive of no more wholesome, healthy and quickening influence, so far as the question of transmission of power was concerned, than the visit of the National Electric Light Association to Montreal. Montreal, Mr. Wiman said, had facilities second to those of no other city, for manufacturing, it had the raw material and the cheapest and best labor, and it needed but the touch of electricity to develop and combine all these advantages so that it would be the greatest city under the sun.

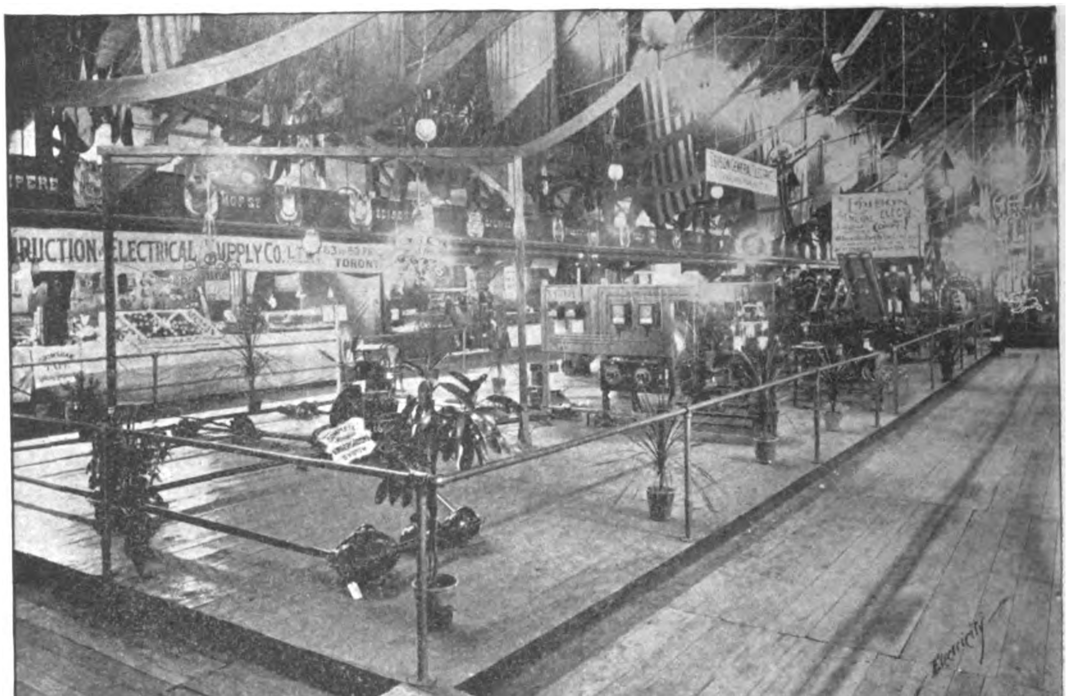
PRESIDENT HUNTLEY'S ADDRESS.

President C. R. Huntley followed with his annual address. He said that as a central station manager he realized the necessity of watching with a keen and observant eye the tendency of conditions and inventions in the electrical field. He was convinced that if central station men wished to secure adequate return on the investments committed to their charge, they must study closely every means of securing higher efficiency of plant and greater economy in operation. "There was a time," said the speaker, "when some of us expected to grow rich out of abnormal prices. To-day there is not one of us who does not know that his hopes of dividend lie wholly in the skill with which the best business ability and the soundest engineering skill are applied to the work in hand." According to Mr. Huntley the best way in which this can be effected is by the adoption of what he termed the "Zone System" of distribution, and which he described as follows:

The idea embodied in this zone system can best be explained, perhaps, by taking a concrete, practical example, and for this purpose the present occasion makes the City of Montreal an interesting one. Setting aside for the moment the possibility and even the probability of the transmission of electrical energy to the city from the power obtained at the Lachine Rapids, we will assume a station erected at the water front of the Harbor, as indicated on my diagram. It will, I believe, be granted that up to within a distance of one-third mile radius, the three-wire low tension direct current system of distribution answers fully every requirement of simplicity and economy, and hence if, with the station as a center, we draw a circle having a radius of one-third mile, we shall have a "zone" supplied in the most economical manner for every class of light and power apparatus now familiar to us.

Coming to the districts beyond the first zone, we are necessarily obliged to have recourse to higher potentials for the feeders, and the selection of the proper potential is a matter of simple calculation. We may, for the sake of this argument, call it 500 volts. Continuing on in this way, in steps of 500 volts, successive zones, half a mile across, might extend in the aggregate, to several miles without reaching the limit of potentials which have been found to be perfectly feasible in practice.

In the example no reference has been made to the nature of the current employed or to the method of local distribution. Evidently we may readily resort to the alternating system, employing converters to reduce or raise the potential, or



Electrical Exposition at Montreal Edison Exhibit, and a General View of the North-West Section of the Hall.

ELECTRICITY

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THE Convention of the National Electric Light Association, at Montreal, last week was successful from every point of view. The hosts of the organization had planned an elaborate programme, and the visitors were kept busy from morning till night in attending the various events arranged for their entertainment. The literary programme was excellent, and the discussions were of a higher standard than usual, as will be noted by the extended report in this issue. The electrical exhibit was the most interesting ever made at a convention of the association. Surely the residents of Montreal have reason to congratulate themselves on the success of the meeting, and the members of the association may well be gratified that they held their convention in the metropolis of Quebec.

* * *

PRESIDENT HUNTLEY, in his annual address, suggested that one instead of two meetings be held by the Electric Light Association each year. The suggestion is a timely one, and his opinion we think is shared by a great majority of the members of the Association.

* * *

THE electrical department of the World's Columbian Exposition excited no little interest at the convention of the National Electric Light Association. Secretary Hornsby explained quite fully the plans which had been made. He also spoke at some length of the electrical congress which it is proposed to hold at the time of the great exhibition. His department, he said, was thoroughly interested in the project, and he did not question that the meeting would be one of the most significant in the history of electrical science.

PAPERS like that of J. I. Ayer, read at the Montreal Convention, are exceedingly beneficial to central station managers. As presented by Mr. Ayer, the topic is certainly interesting to incandescent central station men, as well as to those connected with arc plants. Not only is it a fact that many of the tests applied to the arc lighting station can be applied with good results in incandescent plants; but also that the rules and regulations for governing the employes of the former can often be adopted to a great advantage in the latter.

* * *

IN another column is given a paper on "Different Forms of Carbons used in Arc Lighting," prepared by E. P. Warner for the National Electric Light Convention at Montreal. The results of a very thorough study of the relative values of hard and soft carbons, and of carbons made by different processes, have been before the public for some months. Mr. Warner's paper, as a supplement, will be read with interest by those who carefully count the cost of arc lighting.

* * *

ERASTUS WIMAN made an address at the Convention; but he was careful not to refer to subjects which would have been unpleasing to his Canadian auditors. While the aspect of a United States association meeting in Canada doubtless suggested the idea of annexation, and kindred topics, Mr. Wiman very considerately steered clear of the dangerous ground, and kept to subjects of an electrical nature. Identified as Mr. Wiman is with the Canadian question, the temptation must have been a sore one. His remarks had reference to two topics right in the line of two recent articles in ELECTRICITY. He spoke of the great importance of rapid transit to a city, illustrating his views in a very striking way, and then referred to Montreal in particular as needing transit facilities greatly. He referred at length to the advantages which would accrue to Canada if by a system of electrical transmission the vast water powers of the Dominion were utilized.

* * *

THOSE are indeed fortunate who have water with which to drive their dynamos. Probably many more could avail themselves of it did they know just how to go about it. The data given in Geo. A. Redman's paper, published elsewhere in this issue, make it particularly valuable to those in such a position. Much has been written concerning the utilization of water powers for electrical purposes, and their use for such purposes is constantly on the increase. Such papers as Mr. Redman's are, however, only too rare. There is always room for one more of this character. It shows what foresight and efficient management can accomplish. In his own words, "the Brush Electric Light Company, of Rochester, purchased the entire lower falls of the Genesee River (which are about two miles from the business center of the city) some nine years ago, and at that time it was looked upon by many as a piece of folly," and it was a bold undertaking at that time. The results, as indicated by the business the company are doing and the price at which they are able to furnish lights and power, fully justify the wisdom of the step. We commend this paper to the attention of all who were not so fortunate as to hear it read at the Montreal meeting.

CAPTAIN Eugene Griffin's paper, which appears in full in this issue, contains facts and figures in profusion which would be difficult at this time to collate from their original sources. No one is more competent to handle the electric street railroad subject than he, as his position as chief of the street railroad department of one of the largest selling companies gives him unusual facilities. Street railroad managers in doubt about changing to electricity should certainly read the article with care.

* * *

THE paper of H. Ward Leonard, read before the National Electric Light Association, certainly casts oil on troubled waters. The warfare between the advocates of the direct, the alternating and the storage battery systems has done much to retard the introduction of systems of electric illumination power. Mr. Leonard has pointed out a field in which the three systems mentioned can be combined and made to produce results impossible of attainment in the case of a central station employing but one method of distribution The paper is worthy the careful perusal of all those interested in the financial results of a central station.

* * *

THE speech of E. R. Weeks, at the Montreal convention, in commenting upon the committee report on relations between central stations and parent companies, was a bold and severe attack. He alleged that some manufacturing companies were endeavoring to sell apparatus in towns where plants of their manufacture were already in operation, and the result would be ruin to the pioneers in the field, who had at great expense organized the electric light business. Mr. Weeks' proposed remedy, the formation of a trust or a combination, can hardly be regarded as commendable; neither do we believe that Mr. Weeks seriously recommends this plan.

* * *

THE entertainment programmes for the Electric Light conventions are becoming, we fear, almost too elaborate. If comparisons are to be drawn, few electric light men will care to have the organization meet in their respective cities after the wonderfully hospitable reception at Montreal last week. If this sort of thing continues, the Association will be obliged to meet on some neutral ground, like Cape May—but *horresco referens*.

* * *

WE present in this issue an extended paper which embodies the recommendations of the committee on Tabulating, Wiring and Insurance rules appointed by the National Electric Light Association. Each one must judge this paper for himself, as the committee states, "these must not be considered as rules to be absolutely followed, but rather in the nature of suggestions as to the line upon which each local association may form its own rules in detail." Looking at it in this light, we endorse the report, but still some of its provisions seem unnecessarily severe and almost impossible to comply with, except in particular cases, and serving no useful end where they can be complied with. The extra severity of some of the rules, however, is a fault in the right direction and in strong contrast with the faults of most previous rules and regulations having the same scope, which often permitted laxity, or even absolutely bad construction.

to the direct current reducing from high to low by motor-dynamos. Either one is perfectly practicable. Perhaps some of our new school of electrical engineers will show us how to use the same circuits for both alternating and direct currents.

But, whatever system be employed, I deem it proper to record here my conviction that the most economical way to distribute the current to the consumers at the point of delivery, is by low pressure conductors, in contradistinction to the plan now generally in vogue of giving each customer a converter of his own or, in the direct system, a separate motor-dynamo. I need not here enlarge upon the train of reasoning which has led me to this conclusion, but I may remark that I am strengthened therein by my own experience in Buffalo, where we are now introducing gradually 200 light converters and replacing the smaller ones heretofore employed. Nor do we propose to stop there, but expect to install converters of still higher capacity, distributing the current to a number of customers by low pressure mains centering at the large converters. As addressing myself to practical men I need not refer to the fact that it costs practically no more labor, etc., to put up a 200 light converter than it does a 10 lighter, while the initial cost per light is less in the case of the larger converter. In these conclusions I am only recommending for large commercial areas what, I believe, is now recognized abroad by Ferranti and others, whose work, like our own, will eventually lead to the establishment of large converter sub-stations, from which low tension wires will supply the surrounding districts.

The allusion made to the motor-dynamo system for converting the direct current from high to low potential may to some appear nothing more than the citing of a possible method, in view of the existence of the alternating system, well tried and ready at hand. But without wishing in the least to detract from the merits of this system, which has probably done more to popularize electricity than any other, I cannot, as a practical man, conceal from myself the fact that, taking everything into consideration, the low tension direct current system of distribution is the most flexible within its area and serves the greatest variety of purposes. I do not think that anyone can successfully contradict the assertion that to-day no other system can, with equal efficiency, take care of arc and incandescent lamps, motors large and small, storage batteries, electric heaters, etc.

In making this statement I desire to be understood as referring to the present condition of the art, the only condition which, as practical men, we ought to consider in matters of this kind; but I hope the time will soon come when the same can be said of the alternating system. There are still other methods which suggest themselves, by which the "zone" system could be effectually carried out, but those indicated are sufficient to demonstrate the idea I have endeavored to convey.

After the intelligent station manager has decided upon the nature of his apparatus and the initial capacity of his station, his most important consideration is the allowance to be made for future growth. Look back, some of you, and recall the mistakes made, but which were brought about by the enormously rapid growth of the industry. I need not go out of my own experience for such an example. Less than two and a half years ago we erected in Buffalo a new station, considered far too large for even the most extended future growth. Some of my colleagues shook their heads. Yet, even to-day, it is being worked to its fullest capacity and provision will soon have to be made for more facilities.

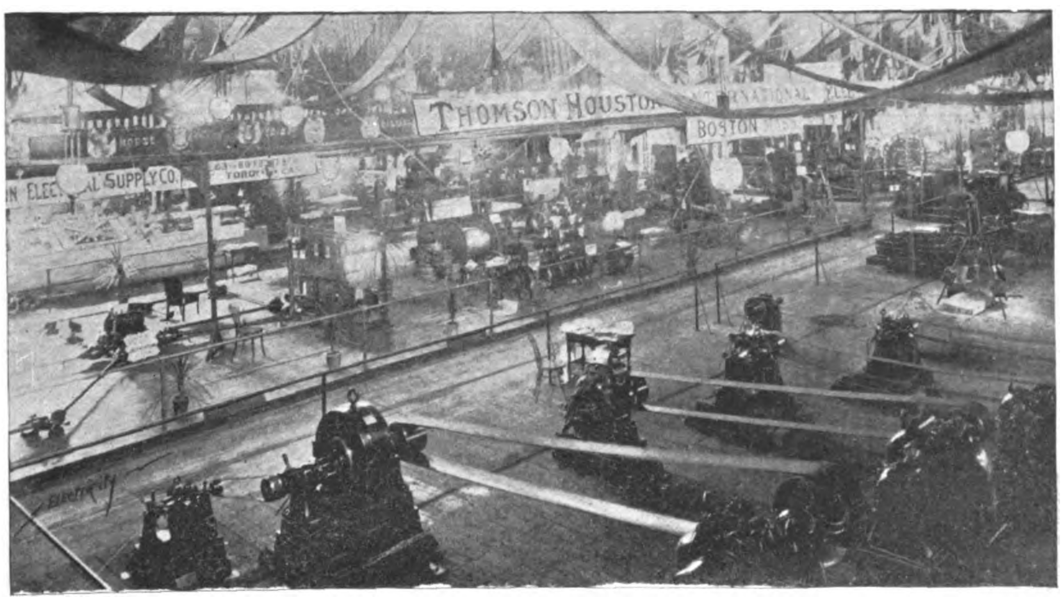
What, then, may be asked, shall we determine upon as the unit time limit of growth for which provision should be made? Shall we build our stations sufficiently large to take care of the demands of five, or ten, or twenty years hence? This is a most serious question, and one to my mind as important as the selection of the proper station apparatus itself. I note the erection of several stations abroad, and some here, designed to supply the demands of fifteen or twenty years hence. Without wishing in any way to detract from the laudable enterprise and faith exhibited by the promoters of these station, a calm survey of the past, present and probable future condition of the art, leads me to believe that the setting of so long a time limit as fifteen or twenty years is inadvisable. I need not remind you in detail of the changes in methods and apparatus which have been effected during the last five years, by which the efficiency and output of our stations have been increased, and if to this we add the fact that already new methods such as those pointed out by Mr. Tesla may at any time increase the present lamp capacity of our station five and ten fold, I think we may be justified in placing five years as the limit of time, to make provision beyond which may involve expenditures, the benefits of which may not be realized.

These are matters we are endeavoring to settle for ourselves. It is to our interest to settle them. So, too, with the underground question, but there we have gratuitous advice, assistance and abuse to such an extent that less progress is made than in any other part of the work. We all want to put our wires underground where the number is so great as to make them unsightly or unwieldly, and not a few of us have been parties to experiments now written off to profit and loss. As soon as the time arrives when every house has its wiring as a matter of course, just as now it has piping for water or gas, it will be a comparatively easy matter to lay down comprehensive underground systems. But at the present time the customers for current are scattered and not continuous. The man with enterprise enough to take electric light and power, soon moves into a larger store. His successor does not want the service, but gropes along with kerosene or spoils his goods with gas. Cutting out disused underground services is an added risk and expense, and ten lights could be installed on overhead circuits for ten dollars, where, with underground, the cost would be fifty. It follows that in any city,—Buffalo for example—we shall not make one underground connection where, with overhead wires, we should have made twenty. Now, are the public or are we the greatest losers? The public, I think. It is as unreasonable in most instances to demand underground wires as it is to expect every railroad to make every crossing above or below grade. But for our overhead wires, America would not be to-day the great land that it is of electrical triumphs; and, while I hail with delight every advance in the solution of the underground problem, I hope long to gladden my eyes with the sight of a pole well set and a wire well strung.

Another stirring question of the hour is that of municipal ownership. Now, it has been taken for granted that electric light men are against this plan, tooth and nail. How absurd that notion is! Because we represent the latest development of invention and industry, we certainly do not forfeit our pride as citizens, nor lose our interest in the advance of social science. It would, in fact, be difficult to find a more progressive, well known body of men in America to-day than they who have put their money and energies into electric lighting. Now, is it strange that such men should object to the confiscation of the properties they have built up and that are beginning to pay? Is it strange that they ask that these new theories in social economy should be tried on something else first? Many of them have grave doubts as to the accuracy of the figures that are supposed to prove that municipal plants pay; others of us have great objection to any taxation, the proceeds of which are to set the municipality up in a commercial business; others again believe that the best results are reached in any industry when it is freest from political influences and is left to the uplifting and perfecting impulses of individual enterprise.

I believe that the most conclusive answer we can make to the sophisticated arguments of an ill-disguised socialism, presenting itself in this municipal ownership scheme, is to give the best service possible at the lowest rates compatible with fair profit. Some of the prices we now obtain are so low as to exclude any profit at all, especially when repairs and reconstruction are considered. But here again we may help ourselves out by native wit. Every company in the ranks of this association ought to ascertain for itself at regular intervals just how it stands as an industry. A good deal of apparatus in use is decidedly inefficient. Overhaul it. If necessary, throw it out and put in better. Above all, adopt a good system of bookkeeping.

In conclusion I would urge that the Association determine upon meeting only once a year. The mere fact that frequent reunions are no longer necessary is in itself a hopeful sign, for it tells of stable and settled conditions and of activities that now require our presence at home pretty well the year round.



ELECTRICAL EXPOSITION AT MONTREAL—THOMSON-HOUSTON INTERNATIONAL COMPANY'S EXHIBIT.

VIEW FROM THE SOUTH-EAST SECTION OF THE HALL.

INVITATIONS.

President Huntley read invitations to visit McGill University, the Art Gallery, the Quebec and Levis Electric Light Company's station at Montmorency Falls. An invitation for a trip on the Richelieu River, and one from the Harbor Commissioners to join them on a trip up the Lachine Rapids were received. The invitations were received, and votes of thanks were adopted. The convention adjourned to 10 a. m. Tuesday.

INTERNATIONAL ELECTRICAL EXHIBITION.

The Victoria Rink, Montreal, was brilliant with arc lights and flags on Monday night, on the occasion of the opening of the International Electrical Exhibition. After Mr. John J. Gulick, chairman of the Committee on Exhibits, had given the gathering which thronged every corner of the building a brief history of the electrical exhibitions held in connection with the meetings of the National Electric Light Association, General C. H. Barney, manager of the exhibition, introduced Sir Donald A. Smith, who formally opened the exhibition. A pretty effect was produced when General Barney held up Miss Bovey, the little daughter of Prof. H. T. Bovey, chairman of the Citizens' Executive Committee, to touch the button which turned on current from the McGill University to start the machinery, and in an instant the air was filled with the hum of revolving wheels. The exhibition was most creditable in every way, and from the way in which it was appreciated by the crowds of visitors, it is evident that it will have no inconsiderable influence in giving a stimulus to electrical development in the city of Montreal.

TUESDAY'S PROCEEDINGS.

At the session Tuesday morning, Judge E. A. Armstrong read a report prepared by George B. Shaw, of Eau Claire, Wis., of the special committee on amendments to the constitution. The committee regarded it as unwise to make any changes in the constitution at the present time.

RELATIONS OF PARENT COMPANIES AND CENTRAL STATIONS.

Judge Armstrong read a report of the committee on the relations between parent companies and central stations, in which it was stated that nothing had come to the attention of the members. E. R. Weeks followed with a speech on the general subject which was listened to with a great deal of interest. In the early history of electric lighting, he said, marvelous and extravagant claims for the efficiency of apparatus were made, and the attitude of the public mind was such that money for new companies was found in abundance. It was soon discovered, however, that the apparatus was short-lived and that investments must be increased to pay for renewals for which the parent companies made little if any discount. It then appeared that the parent companies could not give patent protection, which was regarded as the great consideration for the high prices paid for machinery. The pioneers saw in the field persons employing devices identical with those for which they had paid so liberally. As soon as parent companies, continued Mr. Weeks, found themselves with immense producing plants, and with insufficient demand to keep them in operation, the most powerful of them began to purchase the business of their competitors, and then the temptation to violate their contracts with the pioneer companies proved very strong. "What treachery can be more abominable," asked Mr. Weeks, "than to take such a course with those who had borne the brunt of the new industry struggling for a foothold, who had enriched parent companies, who had created the demand for apparatus that the parent companies had to sell, who, through their own experience had shown inventors and manufacturers wherein their apparatus could be improved and cheapened?" There was a still worse treachery, continued Mr. Weeks. The most formidable and most persistent enemy of the electric light had been the gas interest. It was still opposed to the new light, but now there was a new effort in preparation. "They will wage war with our own weapons, with cheap apparatus furnished by our parent companies. Parent companies are selling to the gas interests and they have the effrontery in their advertisements to boast of their success in disposing of apparatus that employs the very devices whose exclusive control had been guaranteed to the interests that the new purchasers are straining every nerve to kill. And this is being done at a most critical period, when depreciation is becoming known at its full value, when, owing to the general depression, market values of service are at their lowest, and when there is a strong tendency on the part of municipalities to demand of the electric industries expensive, doubtful changes and to curtail their privileges and reduce their rights. The manufacturing companies are indirectly and directly promoting this tendency, and are inciting municipalities to purchase plants, thus depriving local companies of that profitable service which they themselves have created. * * * They are now violating their most sacred obligation and betrayed us to the enemy. * * * The gas companies have fought well to concede to us the period of experimentation, believing that through the treachery of the parent companies they could easily step in and capture the business when its permanent value became known. If, to them, we seem vulnerable on account of the prices which we have paid for apparatus, let us not forget that they too have their undipped heel. Their plants also can be duplicated at much less than their original cost and by improved processes their rates can generally be greatly reduced.

"With regard to the parent companies I will say that you central station men who have created these companies, have the power to check their rapacity and if need be to destroy it. Your interests are identical. You have a peculiar element of strength in that you do not seek to serve the same customers and can therefore never be brought into conflict with one another. Your investments now aggregate upwards of one hundred millions and with stockholders among the best business men, the leading men of affairs in America, you have the power to inaugurate a movement and carry it forward which will be irresistible. Let us enter into a compact whereby we will pledge ourselves to purchase apparatus only of those companies who will treat us fairly, and in case we cannot get such fair treatment, in case we are met by a combination, a trust or a pool on the other side, let us pledge our united support to a new manufacturing enterprise which will enter the field with this guaranteed business to rest upon. If the worst come to the worst, let us with our upwards of one hundred millions of investment call into a common fund from one to five, ten or even twenty per cent. on our investments and standardize our apparatus and do our own manufacturing. You, Mr. President, well know that there are already upwards of twelve millions pledged in writing to this movement. Your committee should push this work forward with all possible vigor as it cannot fail to result in the greatest good to the greatest number.

Judge E. A. Armstrong followed and in commenting on Mr. Weeks' address said: "It is not a desirable thing that any of these methods that Mr. Weeks suggests should be engaged in by us as a corporation or by us as individuals. Not one of them is to be commended. I will take that back—one of them is to be commended—that we engage to deal with those who will deal fairly by us. The others I do not commend and I take it Mr. Weeks does not commend them. No more does he think it necessary to build fortifications, to raise armies, to engage in war. I am heartily in favor of taking the most vigorous methods, using the strongest possible means that we can, firmly to establish our business, and I am more in favor of that from the reason that any such act cannot by any possibility hurt any legitimate enterprise. If that be so, no man can condemn what we suggest doing today."

C. H. Wilmerding, of Chicago, spoke briefly. He said the companies had not yet suffered much, and the suggested combination would take care of the future.

M. J. Francisco said in the course of an address: "It is not, as I look at it, a warfare. It is simply self-protection. That is what we are after and nothing more. We want to simply say to the parent companies that when we have purchased a thing that we should have the right to use it. What we want is protection. We want them to comply with the agreement they made with us, and we want the power if they do not do it, to compel them to do it. That is the position I take in this matter and the position that all central station men should take. Now here is a station established. I go to my people asking them to invest money. What object is there, they ask, in investing money. How do we know but what there are going to be three or four parent companies coming in and establishing plants just as they have done already and compelling us to keep buying them off all the time? Now if a company is organized and started in business especially in places not large enough to sustain two companies, the only object in establishing the rival company is to compel the original company to buy them off or to sell apparatus to some opposing company. If the second company can raise enough money they will wipe out the first company and go on until the parent company comes in and wipes them all out. Now with this arrangement that has been discussed here and was discussed at Providence there is a united effort. The parent companies and the manufacturers understand that it is not for warfare, but simply self-protection and that if they deal squarely and honorably with the central station men they will secure three times the patronage from those central station men that they can get by selling one or two plants to different parties scattered over the country. I have, unfortunately, been drawn into this controversy about municipal lighting and have been very flatteringly noticed by some of the municipal papers over the country in a way which is not very cheering, but I have got so accustomed to it now that I do not think anything about it. But the same principle is involved there that is involved here. A city gets the idea that it can produce lights for about half of what the corporations can produce them for. Some parent companies goes to the officers of the city and proposed to put in a plant. Now they are not only going to furnish the city lighting, but they are going to put in lights and do commercial business right in direct opposition to the local company whose capital is invested there and whose rights that very city has guaranteed by contracting with it to do that business. Now after they have invested their millions of dollars in that property, this parent company tells the city that it can produce its lights for half of what the local company is charging for them. Now that it is entirely wrong and this combination of central companies should be made to meet that point right there, whether it is selling to cities or selling to other opposing corporations; I do not care which it is. They should be met there and they should be forced to abandon that scheme and treat the local and present companies fairly and honorably."

In the course of his remarks T. Carpenter Smith of Philadelphia, said: "We know that there is enough machinery on which the patents have entirely run out which can be used for nine-tenths of the lighting in an electric light station, referring more particularly to arc apparatus. The one feature in an arc machine which has been used to sell apparatus more than another, and which has been used by parent companies one against the other, is that of a good regulator. I have had some little experience—not very much—in arc lighting, and I have found that the best regulator of an arc machine is a good big load. Now I think that there is not a central station in the country but that has bought and paid for enough patent regulators to take care of all their small circuits, all their cut circuits, and I think if this committee put in the hands of all central stations information that would enable them to buy machines which would run their full circuits, and let them keep those for which they have already paid heavy prices, to run their cut circuits, that you have got a weapon to bring the parent companies to a sense of what it means to lose nine-tenths of their business at once. I feel that this committee, if it be continued, should look at the matter in that light. It is information of that kind which we want circulated among the central stations. I know station after station that has enough apparatus to do its whole business, which it cannot use on account of defects in it; its old apparatus, which could be fixed up and do efficient work if its men knew how to fix it. But the parent companies tell them it is necessary to buy new stuff. Advice to buy new material is what they are always met with. What the central station needs is information which will enable it to use the old stuff it has bought and paid for. I believe there is enough apparatus to-day in central stations to do all the business for ten years to come without buying another particle from the parent companies."

Mr. Nichols said: "I have a good deal of sympathy with the parent companies, because as business men we all admire a company that is aggressive in pursuit of business, and while I admire their aggressiveness I must say that I question the policy of their procedure in these matters. It is far better, it seems to me, to have a healthy vigorous company in any one locality, than two or three companies that are slowly dying of inanition and who are cutting each other's throats."

Mr. Weeks' motion that the committee on the relations between parent and sub-companies formulate a plan for the protection of central stations and report the plan to the association in executive session at the next convention was adopted.

H. M. Sutherland read the report relative to the comparison of economy in the generation of power.

THE WORLD'S FAIR.

When the question of World's Fair was reached Secretary Hornsby, of the Electrical Department, was introduced. After describing the site of the World's Fair and the many buildings, he said:

"It is impossible just at this time to tell how far the machinery department will go and where the electrical department will end. In the discussions of the classification committee of the World's Fair a year ago, the electrical department was given a group under the department of machinery and assigned to a corner of Machinery Hall. Its part was inconsiderable and little was thought of it. The two learned gentlemen who assisted the commission to make the classification insisted that electricity was a branch of machinery and as such was entitled only to the consideration of being grouped with machinery. That has been changed. The Electricity Building is 700 feet long by 350 feet wide, having 240,000 square feet of floor space. It has a 100 foot gallery around the entire extent at an elevation of 38 feet. The roof is 160 feet high, of dome shape. The architectural style is the Italian renaissance. The building is to be erected under contract at a cost of $650,000. That is to be purely for the electrical exhibits. An electrical intramural railway will traverse the entire length of the ground. This is a mile and three-quarters. The road will be three miles or thereabouts long. Electrically propelled elevators will be in all of the buildings. Everything that is done in the shape of power will be by electrical transmission. This will be an expensive plant. The various companies engaged in the supply of power and light will be contracted with to build modern model lighting and power stations of their own, after their own plans, to be approved only by

the exposition management. This will be a 24,000 horse power plant."

Mr. Hornsby explained by diagrams the system of distribution, and said that from this plant would be supplied 3,000 arc lamps, 85,000 incandescent lamps and 4,000 horse power for the operation of the machinery belonging to exhibitors.

Continuing, he said: "In our own building I have recently finished the plan. We will require in that building and have arranged for 800 horse power for running our exhibits aside from the operation of exhibits from the exhibitors' own plants which will be located here as well. We will have light in the proportion of one 2,000 candle power lamp to 1,000 square feet of space. In addition to that, in the center of the building we will have some spectacular effects, and in all of the corners; 700 lamps I believe are destined for that building.

"A good deal has been said in regard to the finances of our exposition. The exposition company will spend $26,000,000, the United States government $1,500,000; the states and territories have already subscribed $5,000,000. This is not including $5,000,000 which have been subscribed by foreign governments for the maintenance of their exhibits. The South American states alone have subscribed $2,700,000 for their share.

"The following nations have already replied to the invitation sent by the United States Government: Great Britain, the British Empire, France, Germany, Spain, Japan, China, Mexico, Peru, Honduras, San Salvador, Costa Rica, Colombia, Cuba, Guatemala, Jamaica, Nicaragua, Chili, San Domingo, Turkey, Ecuador, Denmark, Russia, Egypt, Morocco, Venezuela, Brazil, Hayti, and the Argentine Republic. These are what we may expect. It is now eighteen months before our Exposition opens. We have almost the entire world to draw from already. It is impossible to say how far we may have to go. Since the inauguration of the movement to make an Exposition at Chicago it has so developed that the amounts of money already set apart up to a year ago have been found inadequate. Therefore an extra $5,000,000 is being provided by subscription in Chicago, and a loan of $5,000,000 is being arranged for with the United States Government, increasing the resources of the World's Fair to $42,000,000.

"So far as we are concerned ourselves, the electrical department has been divided, the service being absolutely separated from the exhibition department. All of the exhibition will be under the superintendence of the chief of the department of electricity. Everything electrical in the Exhibition will be on exhibition. But this plant here [machinery annex] will be purely a service plant. The exhibition feature will be a secondary consideration. It was contemplated, originally, to install a service plant proportioned to the good will of the electrical people. The management of the exposition thought it would be impossible on account of the general interest taken in the exposition to have the electrical people donate for the use of the exposition enough apparatus and enough talent to serve the purposes contemplated. By the hardest work and closest application of the electrical department we have been successful in having this plant installed purely as a business matter, the idea being to demonstrate unequivocally and in practice the economy of an electrical service over that which was contemplated before —steam and gas. After the Columbian Exposition I think that we will be able to demonstrate fully all that has been claimed for electricity on the score of economy, comfort and luxury if you please.

ELECTRICAL CONGRESS.

"I have been in correspondence for six months or thereabouts with electrical people in all parts of the world relative to holding in Chicago, in 1893, an International Electrical Congress. I have arrived at a point in our correspondence and negotiation at which I can say the project is in the way of being successful beyond our highest hopes. We look for the presence in Chicago at that time of the ablest men in the greatest profession now in existence. The Europeans have promised to have their very highest authorities with us. The best of the electrical people of this country are heart and soul with us. The representatives of the societies in this country and in Europe have signified their intention of taking active hold of the matter of holding this International Electrical Congress. A good many of these congresses have been held heretofore, largely in Europe. A good deal of satisfactory work has been done in the settlement of standards, the unification of methods, the revision of nomenclature, etc. Very little, however, of that work has been done in this country. It seems to be the feeling among scientific men that we are on the eve of a greater revolution than has taken place in the last few years. The chasm which stands between what we know and what we do not know is deep. It may be unfathomable and the hidden recesses of nature may not be for our exploring. On the other hand, some man in the vanguard of this work may brush aside the veil that hangs before us and reveal the thing that has been sought so long. The great revolution may be at hand. Why then may not this be the time? The bringing together of the Nestors of our science, the concentration of thought, the settlement of methods all of these will tend to great good. The standards in the profession can be more fully settled. Unquestionably the nomenclature of the science can be revised, at least in some particulars; and to the world in general such a congress as this would do great good. The question has come up whether this should be done through and by the World's Columbian Exposition or whether it should be done by the various societies. The question should be answered in the affirmative in both instances. It should be done by the societies. They have largely contributed already. It should be done under the auspicies of the United States Government, which is the authority for holding the World's Columbian Exposition. As the representative of the electrical department, as its accredited commissioner to this convention, I will say that the exposition management stands ready now and at all times to aid such a movement in any way. A provision has been made in the report of the presiding officer of the exposition management which will be read before Congress next winter with a view to having the government of the United States take official notice of the contemplated electrical congress. The management of the Exposition has already acquiesced in the proposition to build a hall for holding the sessions of this congress on the Exposition grounds. No money will be spared by the management to make the congress in every way successful, and I hope that at this meeting of this association, strong, powerful, prominent, representative as it is that some action should be inaugurated looking to the starting of the ball which shall roll to be a gigantic one. Something should be developed at this time that would give us a nucleus around which to work. In the course of time the other societies will take their part. The electrical engineers, I understand, have gone far already, and with the help of such societies as these, we have no question about furthering a proposition to hold an International Electrical Congress."

T. C. Martin outlined what had been done by the American Institute of Electrical Engineers to secure an electrical congress in 1893. The society would co-operate with the World's Fair authorities and he thought that the congress would be the most useful and memorable electrical assembly ever held. The following World's Fair committee was appointed: B. E. Sunny, Chicago; Mr. Coleman, Milwaukee; Mr. Price, of New York; Mr. Hart, of New Orleans; Mr. Rice, of Washington.

CENSUS DATA.

Mr. Peck presented, as the report of the electrical section of the committee on data, a form by which to record data concerning street lights.

Mr. Weeks said he had noticed that in census Bulletin No. 100, the figures relating to lights were inaccurate; for instance the statement was made that in San Francisco the price was $440.67 for one arc lamp and $58.46 in Denver. The statements were made without qualification and they were incorrect. The facts were that in San Francisco where coal was $7 a ton the highest price paid for a lamp was $361.90, and that was a 4,000 candle power lamp, located at a point remote from the station. In Denver the rate was $150 within a certain radius and $216 outside of it. Mr. Weeks thought that any form for data relating to street lights should include the matter of distribution.

Mr. Francisco spoke of the fact that erroneous impressions were gained by the mere statement of the price of lamps. For example, the price of arc lamps in Boston was recently stated to be $180, and those in Ypsilanti $13. It might be thought that the people of Boston were outrageously swindled if a person in reading the statement did not know that in that city steam power was used while in Ypsilanti water power was employed.

A. R. Foote said the report of the census office would relieve electric light men of the difficulties under which they had labored by the circulation of erroneous reports. That is, this result would be achieved provided two conditions were met; these were that central station men furnished correct figures and that the census office provided sufficiently competent clerical help.

The motion that the form be adopted was carried.

The question of legislation was taken up. Judge Armstrong, the chairman of the committee on this topic, stated that no report had been prepared.

Mr. C. H. Wilmerding, of Chicago, said two legislative measures, relating to electrical interesss, had been presented in the Illinois legislature, but both had died in committees. One bill authorized cities to carry on a commercial lighting business; the other provided that no circuit should carry over 1,000 volts.

The president stated that there had been no electrical legislation in New York. The electrical commission, in New York City, desiring to retain fat salaries could be depended upon to prevent any immediate action.

Mr. Scott referred indignantly to a measure which had been passed in Pennsylvania providing that any one having knowledge of the cutting or trimming of trees by any electrical companies, could lodge proper information, whereupon the court would appoint a jury to assess damages. "It is not merely the aggrieved property owner but any tramp may lodge an information and damages must be assessed." In Pennsylvania the gas and water companies had exclusive rights. Mr. Scott thought they were not entitled to more consideration than electrical companies.

Dr. Louis Bell spoke of the fact that gas companies in some instances obtained charters for electric lighting, with the intention of keeping out a new electric company. They did not install a plant but held on to the franchise, depriving the people of the advantages of electric light, and charged extortionate prices for gas. He did not know that a legislative remedy could be found, but he thought the matter an excellent one for the association to consider.

Mr. Francisco, of the committee on underground conduits and conductors, said it had been impossible to secure the necessary data and he could not present the report until the next convention.

E. A. Armstrong read the report of the committee on safe wiring.

It was voted that the report be printed as soon as possible and be made a special order for discussion.

The Convention adjourned to Wednesday morning.

GARDEN PARTY AT MRS. REDPATH'S.

A number of the electricians availed themselves on Tuesday afternoon of the invitation of Mrs. Redpath, wife of the donor to the city of the munificent gift of Redpath Museum, to a garden party at Terrace Bank. The visitors were hospitably entertained and enjoyed to the full the ideal surroundings of Mr. Redpath's charming residence.

CONVERSAZIONE AT MCGILL UNIVERSITY.

An event which showed how thoroughly imbued with the spirit of hospitality the Canadians are in their recognition of the visit of the National Electric Light Association to Montreal, was the conversazione at McGill College on Tuesday evening. The visitors were received by Sir Donald A. Smith, Mr. and Mrs. F. R. Redpath, ex Mayor and Mme. Beaugrand, Prof. and Mme. H. T. Bovey and J. W. Beane.

The reception room was beautifully decorated with tropical plants and ferns, and the whole of the arrangements for the entertainment of the visitors were perfect. A large tent was erected in the space between the college and the Redpath Museum, through which the guests promenaded and in which was stationed the band which played throughout the evening. A sumptuous supper was provided, and the conversazione was a brilliant success.

WEDNESDAY'S PROCEEDINGS.

The first order of business at the session on Wednesday was the discussion of the paper by T. Carpenter Smith on the "Distribution and Care of Alternating Currents." The paper was read at the Providence Convention in February last, and excited great interest. The paper was printed in pamphlet form in order that they might have an opportunity to familiarize themselves with the points which Mr. Smith made. Mr. Law opened the discussion by reading the following notes.

MR. LAW'S ADDRESS.

"I find that Mr. Smith has so thoroughly treated this subject, that he leaves little to say. The principal point of success in alternating plants may be stated in one word—"insulation," for on alternating wires a short circuit or ground means as a rule, a burned out armature. I find that in most cases the dynamo man gets tired of renewing the fuses at the generator and will put in a 160 or 200 ampere fuse on a machine that is only adapted to carry 130 amperes. I find that

the better plan is, on a 130 ampere machine to put in a 135 to 140 ampere fuse and then change it often, not waiting for it to burn out. By doing this you keep the machine fused very close to its carrying capacity and the fuse will then go before the armature will become overheated.

Not only should alternating lines be of good insulation, but the primary should in all cases be fused where they branch from the main lines to the converters. In other words, if you follow the insurance rules that have been presented to you for discussion, in primary construction the same as in secondary work, you will find, perhaps, an advantage in it. It is a very common practice to bring these branches directly from the mains to the converters without any protection whatever (other than the insulation on the wire) to prevent contact where one of these wires must cross the primary wires. I have seen a No. 8 wire burn off a No. 0 wire at the point where the primary loops cross the main lines, and a No. 0 wire, charged with a 1,000 volt alternating current, is not a nice thing to have down in the street, especially should the primary loops leading from the main lines to the converters be well insulated, for as a rule they are of small wire, because a large wire is not necessary. These wires are many times quite long, and being small they soon get slack, so that a good stiff breeze will twist them together and unless they are all well insulated, they will burn in two the first time that they are wet and they are not pleasant things to meet on a dark night. If proper fuses are placed where the branch joins the main line, it is not only a protection to your machines and converters but to life also.

When taking charge of a very large station, a year and a half ago, I found practically all the primary fuses were removed from the converters and No. 14 copper substituted, simply because they sometimes blew out. Now a properly placed fuse does not blow out unless there is a cause for it.

There is the greatest of danger in not having the primary wire fused before reaching the converter, although there is a remarkably small number of burn-outs in converters, yet when it does occur there is a danger of the primary wires becoming connected with the secondary and you have a 1 000 volt current at your lamps. All converters are so built that a contact between primary and secondary coils is almost impossible, but if by a short circuit in your primary, it receives a current of from 50 to 100 amperes, when it is only adapted to carry from one to five amperes, it will overheat to such an extent that it will burn any insulation which may be used. This is very liable to cross the primary and secondary wires and you have all the dangers of a high e. m. f. clear to your lamp socket. Properly fusing the primary wires will effectually prevent all this danger.

One weak point I find in alternating central station construction is the double throw switches; they are never large enough, for it is not only to break the usual load of from 50 to 75 amperes on each circuit. In case of a short circuit or ground the current may be three or four times that amount and the fire and noise produced in a break of that kind can be realized only by those who actually perform the operation.

Likewise the fuses are not one half large enough to break radially. These fuses are generally placed on the back of a wooden switch board and are a great source of danger from fire.

MR. FRANCISCO: My experience is that one-half of the trouble we have had in regard to underground and overhead work has been from the loose, miserable manner in which the overhead wires were put up. If the electric light companies themselves had thoroughly installed their system and run their wires in a proper manner, spending perhaps what they have for underground work, we would not have had one-half the trouble we have at the present time. In several cities I have visited in regard to this underground business the officials themselves have said, "Why, if you people would put your wires overhead in proper shape we would not have commenced this raid. But here are these wires strung in a slip-shod, hap-hazard manner, without any system or care, and in many cases without any real insulation, and of course we have to protect the public."

MR. LAW: I will state a little circumstance respecting one of the methods of keeping the meters. This I hardly believed at the time but I traced it down to find out the truth of the matter. The man had pried up the cover of the meter sufficiently to introduce three or four spiders. A few spider webs in there were all that was necessary to retard the meter.

MR. AYER: In Mr. Smith's paper I see no allusion to a thing that seems to me a question, as to the location of the cut-out on the fuse. Some of the manufacturers take the position that those things should be separate and independent of the converter and left on the outside. We know that the practice with others is to put them in.

T. CARPENTER SMITH: I would say with regard to the placing of the fuse in converters that our experience has been that, as a rule, there is little trouble with the primary fuse in the converter except when you want to replace it. It is usually a very ugly job to replace a primary fuse in a converter. We have for a good while now left the secondary fuses out and we have always followed the practice of putting a cut-out immediately at the converter but on the outside. We found that we had a great deal of trouble with the secondary fuses from the fact that they are heavy, and the contacts are not large enough. It is difficult to get contacts that will last three or four months without being corroded. We therefore put copper in those fuses and depended entirely on the cut-out which is immediately outside the converter. On the primary, in some cases, for large buildings, we put cut-outs on the pole and still keep the fuse in the primary end. But we had very little trouble with the primary fuse except in the case of short circuits, in which case the primary fuse always went. We never had any trouble with a short circuit from the blowing of the primary fuse, but I believe others have had that trouble. There are converters now made in which the primary fuses are put on a separate plug and that plug is pushed in and can be taken out and the fuses replaced without touching any high tension wires or connections with the current on. That has another value and that is that the fuses, if required, can be soldered into the plug, and spare plugs be kept on hand, while a lineman can go around once a week or a month, or as often as is thought necessary, and by working the plugs he keeps the contact clean and works off any corrosion that may be in there and keeps a great deal of heat out of the fuses.

MR. AYER: The point that I wanted to get at is leaving the cut-out and fuse outside the converter box. It perhaps has some value in a short circuit coming on the loop. Manufacturers indicate that it is preferable to keep the cut-out or switch in the fuse out of the converter box. The cost of construction is very much greater where the separate box is used, and it is a question whether it is desirable, of course, to obviate this danger of short circuiting on the loop.

CAPTAIN BROPHY: I had a little occasion to look after the installation of electric light wires. I found frequently wires in the primary and secondary side of the transformer instead of fuses — not in one case but in hundreds of cases. The lineman is sent out on a rainy night to replace the fuse. He thinks that a copper wire would save him a good deal of trouble. An accident occurs. Now for that reason I believe that the fuses should be placed in the transformer so that this will not occur.

MR. SCOTT: There are troubles in converter fuses even when they are carefully watched all the time. About two years ago we had one converter that was persistently blowing its fuse. I told the lineman to bring it to the station. The base under the screw head of the fuse connection showed a mark indicating that the fuse had melted there. The screw had become loose, either by the swaying of the pole or the humming of the converter, I never have been able to determine which. The vibration of the screw had formed an arc which had melted the fuse. The brass had become red hot and the switch board below it was completely charred for about half an inch behind it, so that the screw and its base were ready to fall through. After that we made our linemen go through every thirty days and examine our fuses. With secondary fuses I never have known of an accident by one blowing during a thunder storm. Sometimes a whole loop of 18 or 20 converters will have their primaries blow. People are tempted to get small sizes on account of economy, and place them on a line where they have three or four lights to supply. For instance a five-light converter will be put up. The lineman comes along and finds that the fuse wants attention. He has a ten ampere fuse in his pocket and he puts it in. During a thunder storm the lightning or the static electricity on that line attacks the converter, and it finds it easier to burn out that No. 20 or 22 wire than to burn the ten-ampere fuse.

MR. BLANTER: We adopted the method of demanding a guaranteed usage, and if the actual usage is under that guarantee we charge it according to the guarantee, and if the usage is over that we charge it in the same way. This seems to be rather an arbitrary plan, but so far it has worked satisfactorily, and has helped us out considerably.

MR. T. CARPENTER SMITH: I would suggest that the meter manufacturers should be encouraged to get up a meter which could be placed on the primary side of the converter, and let the customer pay for the leakage. He will then keep the number of lights that he is going to install down to those which he will actually use, and he will keep his converter capacity down as soon as he understands that he is to pay for whatever leakage there is.

The paper of George A. Redman was presented as follows:

CENTRAL STATIONS OPERATED BY WATER POWER.

BY GEO. A. REDMAN.

The purpose of my paper is more to give a description of what is being done with water power for electrical purposes in the city of Rochester by the three different electric light companies doing business in that city, and some of my own experience with water power, than to take up your valuable time with the technical description of turbines, which can be gleaned from any of the numerous catalogues of turbine manufacturers, which contain full descriptions of turbines and their construction.

The adaptation of water power for electrical purposes has grown very rapidly within the past few years; there are several causes operating to enhance the value of water power, none more so than that of electricity.

Streams that have had no pecuniary value heretofore are now being utilized for the purpose of running electrical machinery, yet at the same time the supply of water is diminishing, caused by the destruction of forests, and water right owners in various parts of the country are devising means of storing water during the rainy seasons to furnish a supply during the dry season; also storing it in the daytime for night use. One large water right owner in Western New York, during the months of July and August, places flash boards two and one-half feet high on top of his dam, at an expense of \$100, and stores up for night use the water which is not necessary for him to use in the daytime, thereby saving in the two months a coal bill equivalent to \$1,100.

The Johnstown, N. Y., Electric Light Company have improved their water power at the Cuyadota Falls by erecting a dam 34 feet high on top of the falls, giving them a total head of 75 feet and nearly doubling the amount of power.

A survey of the upper Genesee River, between Mount Morris, N. Y., and the celebrated Portage Falls, has been made during the past year for the purpose of establishing a reservoir that will furnish the city of Rochester 30,000 horse-power more daily during the entire year than they have at present.

The earliest forms of water wheels were the paddle and flutter wheels that only utilized the impulsive action of the water; these were followed by simpler wheels of the reaction type and others.

We now have the improved forms of the Leffel, Victor, Lesner, Success, and many others. There is a demand for the best and most economical turbine that can be manufactured.

Turbines should be built to secure the delivery of the water upon the turbine without checking the velocity of the water more than one-third, and permit the free discharge of same after passing through the turbine, and to work with as good efficiency under part gate as under full gate, and to be made of the best phosphor bronze; to stand the wear and tear under high heads.

It is essential in locating central stations to be run by water power, to locate them where there is no great danger of a flood, or so protected by a breakwater as to make it perfectly safe, and also to avoid trouble with back-water upon the turbines.

Where a station is situated on the bank of a river it is best to take the water from the river by means of a raceway, with the headgates parallel with the flow of the water, and at times of a freshet or running of anchor ice, it will more than pay any expense incurred by so doing.

The raceway should be of a sufficient depth and width to permit the water to flow not more than 90 feet per minute, and a waste gate should be placed in the side or end of the race to use in case of emergency; and when cleaning out the raceway a rack should be built across the race to prevent driftwood and other rubbish from passing into the turbines.

For that purpose I would recommend a rack built of iron slats two inches wide, one-eighth of an inch thick, and placed five-eighths of an inch apart on seven-eighth inch iron rods, at an angle of 45 degrees. Particular attention should be taken to keep the rack clean by raking. A trough or platform should be placed over and mmediate-

ly back of the rack to rake the rubbish and anchor ice into, and so arranged that a current of water from the race will pass through the trough and carry off all the rubbish, etc. For any station that is using 100 horse power or over, it will be a great saving in labor to them and pay well for the extra expense. For winter service a boom should be placed in front of the headgates, and the current will carry off a large portion of the anchor ice and other floating objects.

The headgates should be built to work with a rack and pinion; also a roller should be placed back of each gate stem to facilitate the handling of the gate.

The gates should have a protection built over them, to protect the gearing from the storm. In a cold climate, where the gates are apt to be frozen in, salt is essential in freeing them from ice. All headgates and timbers should be of the best quality of oak, and should be well bolted, and not less than two gates to one raceway. The tail race should have not less than two or three feet of dead water when the wheels are not in motion.

Where the tail race runs under the station, cement floors should be laid to prevent moisture in the station; a floor of that material will soon pay for itself.

Vertical turbines should be placed so that the steps are covered with water at all times. In adapting turbines to very high heads, or to conform to location, it becomes necessary to set the turbines above tail water, and conduct the water away from the turbines, through a draft tube; the same depth of pit and area of discharge is required where a draft tube is used, as would be when the turbines are set at the bottom of the fall; the mouth of the draft tube should always be submerged about six inches in standing tail water. It is claimed that draft tubes can be used 30 feet in length. I do not think a draft tube more than 18 feet in length should be used, on account of the difficulty in keeping the tube air tight, for if the tube leaks the vacuum is imperfect and there will be a great loss of power, and where steps are used they will be apt to be burned out.

When possible, I would advise horizontal turbines to be used, as they are easier taken care of, and many of them are used without any steps. The burning out of steps is an expense and annoyance. One of the greatest advantages in the horizontal turbine is that the dynamo can be belted direct to the turbine shafting, and in some cases coupled direct to turbine, making a good percentage in economy in power and avoiding the use of gearing, and I deem it advisable to put in a number of small turbines, instead of one large one; in case of a break-down, they are more easily repaired and cause less delay to customers.

In the old station of the Brush Electric Light Company, of Rochester, the vertical turbines caused considerable annoyance in the burning out of steps and stripping of the gears; so much so, that it became necessary to support the vertical shafting with water cushions. For wooden steps we have had the best success with lignum vitæ.

In my opinion, governors for the turbines are necessary and will govern any slight variation of load under high head, but where one-third or over of the load is thrown off or on suddenly, it is necessary to handle the gate by hand, as under the above circumstances the turbine is apt to slack down or run far above the normal speed, as the case may be; in the latter case causing the burning out of lamps and armatures. The governors should be placed as near the turbines as possible to save lost motion in the gate shafting and avoid the use of gearing as much as possible.

We have two governors in use in our office building under a low head of 16 feet, and they govern the the turbines under all circumstances in quite a satisfactory manner.

The decided advantage of a water power station over the one run by steam power, is not only one of economy in the saving of the expense of coal, but the station and apparatus can be kept cleaner and cooler, thereby saving considerable in expense of repairs, and it is also far more pleasant for the employes.

The Brush Electric Light Company, of Rochester, purchased the entire lower falls of the Genesee River (which is about two miles from the business center of the city) some nine years ago; at that time it was looked upon by many as a piece of folly, to think of running dynamos there, on account of the distance from the business centre of the city and the dampness around the Falls. Notwithstanding the adverse opinions, they erected two buildings on the west side of the river above and near the brink of the Falls, and put in two 30½-inch Leffel, two 20-inch Victors, and one 40-inch Leffel turbine, the first four mentioned turbines, under 94 feet head, and the latter under 28 feet head, with a total of 2,500 horse power. After running this power for five years, they built a new station and leased their old power to different parties for pulp and flour mill purposes.

The new station is a three story stone building, 45 feet wide and 90 feet long, with a two story brick addition 42 feet wide and 80 feet long, and located at the foot of the Falls on the east side of the river. The turbine capacity consists of 15 double 15-inch horizontal Lesner turbines under 90-foot head, with 14-foot draft tubes, a total of 3,360-horse power, using 6.95 cubic feet of water per minute per horse power; have had but one turbine damaged to any extent in four years. The turbine casings are placed on iron girders resting on solid rock.

The amount of floor space occupied by all of the turbines is 4 feet by 38 feet; the weight of each turbine is 196 pounds, less than one pound to a horse power; each turbine is placed in a separate division of the casings and the shaftings extend through the shafting room, upon iron bridgetrees, with seven feet and six inches between journals, and the dynamos are belted direct to the turbine shafting; the shafting runs at 800 revolutions per minute, with 25-inch pulleys on the turbine shafting and 24 inch on the dynamos; we use untried beef tallow for lubricating and are well satisfied with its results. The turbine gate shafts and governors are placed in the dynamo room at an average distance of 14 feet from the turbines, where they are easily handled by the attendants. We have in use four different styles of Governors: the Walsh, Snow, Pritchard—electric, and one friction. With the latter we have done some experimenting. A tell tale is placed in the shafting room, connected to a float in the race above the Falls, which shows the height of water in the race at all times.

The water is taken into the raceway, about 80 feet above the Falls; the race is 32 feet wide, and five feet six inches deep and cut through the solid rock; there are four headgates with a house built over them; a wooden diagonal rack is placed in the race near the spillway to assist in freeing the race from anchor ice; the spillway is six inches deep and 32 feet long. The waste gates are placed next to the spillway and are three feet six inches wide; there are two of them. In front of and near the top of the penstocks an iron rack is built according to dimensions given; also a rubbish trough.

There are three iron penstocks, six feet in diameter and 80 feet high, built of three-eighth-inch boiler iron, with a gate to each penstock.

There are five elbows to each penstock leading to as many turbines, with an iron slide gate to each elbow; in addition, each turbine has a register gate, thereby permitting the repairing of any one turbine without interfering with the running of the others. A turbine can be taken out and another put in its place in 25 minutes.

Cement floors are laid in the shafting and turbine rooms.

There are three tail races, extending under the entire length of the main building; each race is nine feet wide and six feet six inches deep.

As a reserve power, when making repairs and cleaning the raceway, we have a 600-horse power Cooper Corliss engine; in the past year it has been necessary to use it but a few days.

For fire protection, two-inch iron pipes are run from the penstocks through both buildings with four lines of hose attached at all times; the hose is tested once a week; in addition to the hose, a dozen fire pails filled with water and placed in different parts of the station are kept in readiness, and are not permitted to be used for any other purpose.

A record is kept of the time of starting and stopping of each turbine, also the speed and load on same, and any variation in height of water, and all repairs that are made. In addition to the above records, the day and night wheelmen report the condition of the power at the time they are relieved.

There are nine men employed at the station, five of them in the dynamo department and four in the water power department.

We have in service 30 dynamos: three of them are run without any stoppage and the balance of them on an average of 13 hours per diem.

A record book is kept in the dynamo room, in which entries are made of the time of starting, stopping, speed and load of each dynamo, also all repairs of every description, all accidents to either machinery or circuits, nature, time and cause of same.

All the circuits are tested five times daily, and the tests and time of same entered in record book.

By the means of water power the company is enabled to furnish cheap and satisfactory light and power at the following rates, viz:

City arc lights, all night and every night, 27 cents per night; Commercial arc lights, all night and every night, 40 cents per night; Commercial arc lights, evening, 25 cents per night; Commercial arc lights, evening and all day, 40 cents; ⅛ horsepower motor, $18 per annum; ½ horsepower motor, $48 per annum; 1 horsepower motor current, $72 per annum; 2, 4 and 6 horsepower motor current, $50 per annum per horsepower; 8, 10 and 15 horsepower motor current, $40 per annum, per horsepower; ⅛ horsepower fan motors, $15 per season, from June 1st to October 1st; 16 candlepower incandescent lamps, $5 to $12 per annum; 25 candlepower Bernstein lamps, $12 per annum; 50 candlepower Bernstein lamps, $24 per annum; 100 candlepower Bernstein lamps, $48 per annum.

The rates I have mentioned are for arc circuits; our rates for current on 500 volt constant potential circuits are as follows, viz:

1 horsepower, $48 per annum; 2 horsepower, $96 per annum; 5 horsepower, $180 per annum; 8 horsepower, $240 per annum; 10 horsepower, $300 per annum; 15 horsepower, $450 per annum; 20 horsepower, $600 per annum.

We operate a total of 832 motors, of which 196 are fan motors, 1,396 arc, 135 Bernstein and 200 Swan incandescent lamps. One motor circuit contains 26 miles of outside wire and 394⅛ horsepower "C. & C.," one 2 horsepower and one 4 horsepower Brush motors, and is run with a No. 8 Brush arc dynamo. We have one 40 K. W. 500 volt "C. & C." generator in service, on an eight mile circuit, with 48 horsepower in motors in use, the ammeter averages 29 amperes. We experience no difficulty in running same with our power. The twenty-six mile motor circuit is the most popular circuit we have, and is run through the north-east suburban portion of the city. All the motors on this circuit, with a few exceptions, are placed in tailor shops that are either in the dwellings or in shops built in the rear of the dwellings.

The rebate for poor service during the year ending December 31, 1890, was one one-hundredth of one per cent. of the gross receipts, and the uncollected accounts for the same period was one-tenth of one per cent. of the gross receipts.

The Edison Electric Light Company have recently erected a three-story stone station at the foot of the upper Genesee Falls, on the west side of the river, and have at present two double discharge Leffel mining wheels under about 90 feet head, giving 600 horsepower, and are placing two more of 400 horsepower each. In addition, they have a fine steam station in the center of the business district. Incandescent 16 candlepower lamps are furnished at one cent per hour; arc lamps for city use, 28½ cents per night; municipal incandescents at six cents per night. The latter they are partially replacing with arc lamps. They have in circuit 105 arc, 805 municipal and about 13,500 16 candlepower incandescent lamps.

The Rochester Electric Light Company's plant is situated at the upper Genesee Falls on the east side of the Genesee River, near the business center of the city.

The station is three stories in height from the top of the Falls, with the wheel pit underneath, blasted out of solid rock 95 feet in depth. They have five Leffel horizontal turbines, four are 23 inches, and the other 30½ inches in diameter, with a total of 1,500 horsepower, under a head of 86 feet and 8 inches.

The penstock is a steel pipe seven feet in diameter; the power is transmitted to five shafts 80 feet above by belts 173 feet in length, running at a speed of 7,200 feet per minute.

The dynamo room is directly over the shafting, from which all of the dynamos are belted through the floor. The dynamos are the United States system. They have in service 325 city arc and 140 commercial arc lamps; also 1,500 incandescent lamps and two 10 horsepower motors. They have just placed one 85 horsepower generator and one 1,500 light Westinghouse alternating dynamo.

As a reserve power, they are putting in a 100 horsepower engine. The city lights are being furnished at 27 cents per light.

In addition to those I have mentioned, there are five incandescent plants and one arc isolated plant run by waterpower in Rochester, some 500 incandescent and 25 arc lamps, making a grand total of 1,991 arc and 16,640 incandescent. The population of Rochester is 135,000, making a very high average per capita.

DISCUSSION.

Mr. Redman: We have two motor services—one running in the northern portion of the city, and the other in the northwestern district, where, with very few exceptions, the motors are placed in dwellings or in small shops built in the rear of dwellings. Heretofore the small manufacturers resident there have done business in the center of the city, and on the fifth or sixth floors of buildings, but now they do their manufacturing at home, either in their dwellings or in small shops,

As a boss tailor remarked to me the other day, when he did his work down in the city he only worked himself, but now, said he, "mine frau and all the children work."

MR. ARMSTRONG: We get 39 cents for 2,000 candle power lights every night, and all night, while here the price is stated by Mr. Redman as 27 cents for city arc lights. I see that for commercial lighting, all night and every night, forty cents per night is obtained by this company, which only has to use coal for half a day during the whole year. The facts shown by these figures, as they go out, ought to be strongly emphasized, and the fact ought to be just as strongly emphasized that nothing but water power is used by this company. And the further fact ought to be emphasized that in addition to the fact that the water power cost nothing so far as the electric light is concerned, 2,500 horse power is sold. So that the incidental expenses, as I apprehend, and possibly the investment itself is paid for by the sale of water power in addition to the sale of electric lights.

MR. REDMAN: You will notice that two other companies charge the same price. There are three companies doing business there.

MR. ARMSTRONG: And practically you get the same price. Are they also using water power?

MR. REDMAN: Both water and steam.

MR. ARMSTRONG: My purpose in rising was simply to call attention to the fact and to impress it upon our minds, that these differences in figures are due to the fact that the water power in Rochester furnishes the original power at almost if not nominal cost.

MR. FRANCISCO: Do you make any difference with regard to the business you are running.

MR. REDMAN: No, sir; not unless it is used for ventilating purposes. Where a one horse-power is used for ventilating purposes we get $120. It is for constant service. We do not use any meter.

MR. FRANCISCO: My experience is that there is a difference in the business. I am running at the present time a 30 horse-power motor, and running an entire factory with it. In that factory they have a Daniel's planer, and that takes 44 amperes to run it. When they first started I could not understand what was going on down there. They would throw on the 44 amperes of current, while their motor was not intended for such an arrangement. I went down and investigated the matter, and found that it all depended upon the way they were running that planer. They would set it for a quarter inch strip, and put on the 44 amperes, whereas if they would set it for an ordinary work, it would only take 40 amperes with a 500 volt current. The point was just here: that in doing their planing, if they took only a thin shaving they have got to run the board through twice, whereas if they take a thick shaving they run it through but once, and it takes but half the time. We charge the same rate for light and power—25 cents per thousand watts. But we have found in respect to its use for power that there is a vast difference in the kind of business in which the power is used. We are running a motor for a daily paper. They used to run that paper with water power and a steam engine, and it took them four or five hours to run off an edition. We started in, and they supposed that it would take the same length of time to run off the edition with our motor as it did with the water motor and engine, and we based our contract upon that supposition. They have found, since they put our motor in, that it requires just one hour and ten minutes to run that edition through, instead of four or five hours. Our contract, however, was based on the experience which they have had with the water motor. They only used the motor while that edition is being run off,—for the one hour and ten minutes; whereas, in another class of business, as in running an elevator, they will run the motor through ten hours of service. In one store they are running a passenger elevator, a freight elevator, a cash system, and a coffee grinder—all with the same motor, and they are running it for ten hours. They run it under a contract. If we charge for horse-power so much for ten hours service, of course, in that case we would lose; whereas, in another case, where we charge by the horse-power the motor might not be in service half the time. So you see that there is a vast difference in the employment, so far as the motor business is concerned. We are also running a freight elevator in a store, which is run on a meter. In the first place the man was afraid of the meter, and said that he would prefer to make a contract for a specified sum. He said that he had had some experience with meters—and, by the way, he is a director in a gas company. So we made a contract with him for the motor, but for my own information I put a meter in. At the end of the first month he paid his bill according to the contract. When I went then to look at the meter at the end of the second month he said, "Of course it is nothing to me, but how much does that meter indicate?" Said I, "It would cost you just one-third of what you are paying." I charged him $60 per year for a five horse-power motor. I find that as to other classes of business it is the same. I find that a job printing office is one of the very worst places you can get into.

MR. LEONARD: Mr. Francisco states that he charges 25 cents per thousand watts. I want to ask him what he means by that.

MR. FRANCISCO: A thousand watts is 746 watts in horse-power. When a man uses 1000 watts he has used a horse-power and a fraction beyond that. When he has used 1000 watts he pays 25 cents. That is our rule.

MR. LEONARD: That is a pretty heavy charge, I think, for power,—it is 12 cents per hour.

MR. FRANCISCO: But remember that we are running on steam power, where coal costs us $4.50 per ton. And here is another picture: The entire installment is under our care.

MR. WILMERDING: If we could get the rate of 25 cents per thousand watts we should prefer the meter; but I have found the meter system unsatisfactory, because the character of the service varies so much. Our charge for elevator service is from five dollars per month to fifteen dollars. That is on the basis of ten cents per thousand watt hours. On our contract prices we make three rates: We have a rate for continuous power, a rate for intermittent power, and a rate for elevator service. For the elevator service we charge $5 per month per horse-power, or $60 per year. That is for any kind of elevator service. But I have never found that any of those elevators when run on the meter show more than one-third of what our contract price would give us. I have also found that our customers are more surprised than we are at the small price they have to pay for the service. For that reason I have concluded recently that we will not furnish any elevator service on the meter. [Laughter.] We do not want to surprise them in that way. That comes to about six cents per horse power.

MR. FRANCISCO: What is the cost of coal?

MR. WILMERDING: Our coal cost $2.65 per ton, but we are using compound condensing engines, and our indicated coal consumption is not more than two pounds per horse power hour.

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MR. SCOTT: I thought that this was a discussion of the paper relating to the operation of central stations by water power, and the point that interests me is to know the relative cost of production by water and by steam. From what I have seen in my own section of the country I judge that water power has not superseded steam. The companies there can run on high pressure engines and furnish sixteen candle lamps per hour at an expenditure of half a pound of coal, whereas water will cost them as much as six-tenths the cost of a pound of coal, and when water costs them that much they are not likely to discard steam for water. I do not find in this paper a statement of that element of cost. The paper speaks of the rebates costing only one-hundreth of one per cent. The rebates do not cost us that, as we only give rebates back to the men who kick so outrageously that we cannot get rid of them. It costs Mr. Redman something to keep up his race-way, and it costs something to repair dams. There are floods. There is no water power that is proof against damages by floods. Then there is the expense of cleaning out his pond. If those repairs, and the wages of the men who are delegated to make those repairs, cost as much as buying a load of coal, why should we not buy the coal? I want to get at the facts which will show me whether it will pay us to throw out the coal and take in water. I never take water in mine when I can help it.

MR. LEONARD: I have had some experience in connection with the running of stations by water power, and I think that the remarks of the last speaker are very pertinent and correct and that the cost of water power, although it is apparently cheaper than steam, is frequently higher than it would have been for a first class steam plant. I think, further, that water power is really not sufficiently constant to entirely eliminate the steam plant. With the exception of a few plants where the water power is peculiarly favorable, the water power has to be assisted by a steam plant, and the ultimate expense is frequently higher than it would have been if they had entirely disregarded the water power and built the steam plant at the best possible location. In my own experience I find that the best use to make of water power is not that of operating a full load, but of taking care of that portion of the load which is quite light, and which operates between, I will say, 11 o'clock at night and dawn of the next day, for the load is fairly constant during those hours, and the economy of the water power is then more marked, because the services of an engineer may be dispensed with. The use of the water power has proved to be very economical in certain places where a not very reliable water power existed, but where perhaps fifty or one hundred horse power could be obtained at almost any period of the year, and which would answer to carry a light load during certain hours of the day and late at night.

T. CARPENTER SMITH: I think that at most central light stations the best use to make of the water power is to use it in condensing. Steam has an enormous advantage over water power in that with steam you can state almost to a certainty just what your power will cost you. There has been such an enormous experience in steam, and so many statistics have been collected, that the cost per annum per horse power of steam has been determined within very small limits for all the types of engines in use. With water power, on the other hand, the contingent expenses are very likely to far more than offset the original cheapness of the water power. If a steam engine has really to be installed anyway as a relay to the water power, you might as well run with steam all the time, for you have got to keep your engineer there, and you have got to keep your fires ready for lighting. And further, a steam engine possesses the ability to be driven beyond its rated capacity, whereas your water wheel is absolutely limited to the power contained in the head, and in case any sudden call is made upon you for increase of power, you must either shut down, or start your engine. And if you have to keep your engine ready to start up, it is better to keep it going the whole time.

The following paper by H. Ward Leonard was read:

A CENTRAL STATION COMBINING THE ADVANTAGES OF BOTH THE CONTINUOUS AND ALTERNATING CURRENT SYSTEMS.

BY H. WARD LEONARD.

We are all well aware of the fact that the greatest strength of the three-wire system is due to features, the lack of which constitutes the greatest weakness of the alternating system, and that the reverse of this statement is equally as true.

The high efficiency, reliability, safety and adaptability to supply almost any requirements for electric energy, which are the features of strength of the three-wire system, are the very points upon which the alternating system suffers by comparison, for its efficiency is much lower, its reliability is less due to the fact that its machines are not practically operated in multiple arc, its safety is necessarily less due to the existence of the high primary pressure, and its current is not adaptable to commercial use for motors, charging storage batteries, electro deposition, and so forth.

On the other hand, the low first cost of an alternating system, the simplicity of its circuits and of the operation of the central station, and its ability to reach with moderate expenditure of capital, lighting at any practical distance, make it the only possible pioneer in new and untried territory without great risk and almost the certainty of expending capital which will never be remunerative.

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ly back of the rack to rake the rubbish and anchor ice into, and so arranged that a current of water from the race will pass through the trough and carry off all the rubbish, etc. For any station that is using 100 horse power or over, it will be a great saving in labor to them and pay well for the extra expense. For winter service a boom should be placed in front of the headgates, and the current will carry off a large portion of the anchor ice and other floating objects.

The headgates should be built to work with a rack and pinion; also a roller should be placed back of each gate stem to facilitate the handling of the gate.

The gates should have a protection built over them, to protect the gearing from the storm. In a cold climate, where the gates are apt to be frozen in, salt is essential in freeing them from ice. All headgates and timbers should be of the best quality of oak, and should be well bolted, and not less than two gates to one raceway. The tail race should have not less than two or three feet of dead water when the wheels are not in motion.

Where the tail race runs under the station, cement floors should be laid to prevent moisture in the station; a floor of that material will soon pay for itself.

Vertical turbines should be placed so that the steps are covered with water at all times. In adapting turbines to very high heads, or to conform to location, it becomes necessary to set the turbines above tail water, and conduct the water away from the turbines, through a draft tube; the same depth of pit and area of discharge is required where a draft tube is used, as would be when the turbines are set at the bottom of the fall; the mouth of the draft tube should always be submerged about six inches in standing tail water. It is claimed that draft tubes can be used 30 feet in length. I do not think a draft tube more than 18 feet in length should be used, on account of the difficulty in keeping the tube air tight, for if the tube leaks the vacuum is imperfect and there will be a great loss of power, and where steps are used they will be apt to be burned out.

When possible, I would advise horizontal turbines to be used, as they are easier taken care of, and many of them are used without any steps. The burning out of steps is an expense and annoyance. One of the greatest advantages in the horizontal turbine is that the dynamo can be belted direct to the turbine shafting, and in some cases coupled direct to turbine, making a good percentage in economy in power and avoiding the use of gearing, and I deem it advisable to put in a number of small turbines, instead of one large one; in case of a break-down, they are more easily repaired and cause less delay to customers.

In the old station of the Brush Electric Light Company, of Rochester, the vertical turbines caused considerable annoyance in the burning out of steps and stripping of the gears; so much so, that it became necessary to support the vertical shafting with water cushions. For wooden steps we have had the best success with lignum vitæ.

In my opinion, governors for the turbines are necessary and will govern any slight variation of load under high head, but where one-third or over of the load is thrown off or on suddenly, it is necessary to handle the gate by hand, as under the above circumstances the turbine is apt to slack down or run far above the normal speed, as the case may be; in the latter case causing the burning out of lamps and armatures. The governors should be placed as near the turbines as possible to save lost motion in the gate shafting and avoid the use of gearing as much as possible.

We have two governors in use in our office building under a low head of 16 feet, and they govern the the turbines under all circumstances in quite a satisfactory manner.

The decided advantage of a water power station over the one run by steam power, is not only one of economy in the saving of the expense of coal, but the station and apparatus can be kept cleaner and cooler, thereby saving considerable in expense of repairs, and it is also far more pleasant for the employes.

The Brush Electric Light Company, of Rochester, purchased the entire lower falls of the Genesee River (which is about two miles from the business center of the city) some nine years ago; at that time it was looked upon by many as a piece of folly, to think of running dynamos there, on account of the distance from the business centre of the city and the dampness around the Falls. Notwithstanding the adverse opinions, they erected two buildings on the west side of the river above and near the brink of the Falls, and put in two 30½-inch Leffel, two 20-inch Victors, and one 40 inch Leffel turbine, the first four mentioned turbines, under 94 feet head, and the latter under 28 feet head, with a total of 2,500 horse power. After running this power for five years, they built a new station and leased their old power to different parties for pulp and flour mill purposes.

The new station is a three story stone building, 45 feet wide and 90 feet long, with a two story brick addition 42 feet wide and 80 feet long, and located at the foot of the Falls on the east side of the river. The turbine capacity consists of 15 double 15-inch horizontal Lesner turbines under 90-foot head, with 14-foot draft tubes, a total of 3,360-horse power, using 6.95 cubic feet of water per minute per horse power; have had but one turbine damaged to any extent in four years. The turbine casings are placed on iron girders resting on solid rock.

The amount of floor space occupied by all of the turbines is 4 feet by 38 feet; the weight of each turbine is 196 pounds, less than one pound to a horse power; each turbine is placed in a separate division of the casings and the shaftings extend through the shafting room, upon iron bridgetrees, with seven feet and six inches between journals, and the dynamos are belted direct to the turbine shafting; the shafting runs at 800 revolutions per minute, with 25-inch pulleys on the turbine shafting and 24 inch on the dynamos; we use untried beef tallow for lubricating and are well satisfied with its results. The turbine gate shafts and governors are placed in the dynamo room at an average distance of 14 feet from the turbines, where they are easily handled by the attendants. We have in use four different styles of Governors: the Walsh, Snow, Pritchard electric, and one friction. With the latter we have done some experimenting. A tell tale is placed in the shafting room, connected to a float in the race above the Falls, which shows the height of water in the race at all times.

The water is taken into the raceway, about 80 feet above the Falls; the race is 32 feet wide, and five feet six inches deep and cut through the solid rock; there are four headgates with a house built over them; a wooden diagonal rack is placed in the race near the spillway to assist in freeing the race from anchor ice; the spillway is six inches deep and 32 feet long. The waste gates are placed next to the spillway and are three feet six inches wide; there are two of them. In front of and near the top of the penstocks an iron rack is built according to dimensions given; also a rubbish trough.

There are three iron penstocks, six feet in diameter and 80 feet high, built of three-eighth-inch boiler iron, with a gate to each penstock.

There are five elbows to each penstock leading to as many turbines, with an iron slide gate to each elbow; in addition, each turbine has a register gate, thereby permitting the repairing of any one turbine without interfering with the running of the others. A turbine can be taken out and another put in its place in 25 minutes.

Cement floors are laid in the shafting and turbine rooms.

There are three tail races, extending under the entire length of the main building; each race is nine feet wide and six feet six inches deep.

As a reserve power, when making repairs and cleaning the raceway, we have a 600-horse power Cooper Corliss engine; in the past year it has been necessary to use it but a few days.

For fire protection, two-inch iron pipes are run from the penstocks through both buildings with four lines of hose attached at all times; the hose is tested once a week; in addition to the hose, a dozen fire pails filled with water and placed in different parts of the station are kept in readiness, and are not permitted to be used for any other purpose.

A record is kept of the time of starting and stopping of each turbine, also the speed and load on same, and any variation in height of water, and all repairs that are made. In addition to the above records, the day and night wheelmen report the condition of the power at the time they are relieved.

There are nine men employed at the station, five of them in the dynamo department and four in the water power department.

We have in service 30 dynamos: three of them are run without any stoppage and the balance of them on an average of 13 hours per diem.

A record book is kept in the dynamo room, in which entries are made of the time of starting, stopping, speed and load of each dynamo, also all repairs of every description, all accidents to either machinery or circuits, nature, time and cause of same.

All the circuits are tested five times daily, and the tests and time of same entered in record book.

By the means of water power the company is enabled to furnish cheap and satisfactory light and power at the following rates, viz:

City arc lights, all night and every night, 27 cents per night; Commercial arc lights, all night and every night, 40 cents per night; Commercial arc lights, evening, 25 cents per night; Commercial arc lights, evening and all day, 40 cents; ⅛ horsepower motor, $18 per annum; ½ horsepower motor, $48 per annum; 1 horsepower motor current, $72 per annum; 2, 4 and 6 horsepower motor current, $50 per annum per horsepower; 8, 10 and 15 horsepower motor current, $40 per annum, per horsepower; ⅛ horsepower fan motors, $15 per season, from June 1st to October 1st; 16 candlepower incandescent lamps, $5 to $12 per annum; 25 candlepower Bernstein lamps, $12 per annum; 50 candlepower Bernstein lamps, $24 per annum; 100 candlepower Bernstein lamps, $48 per annum.

The rates I have mentioned are for arc circuits; our rates for current on 500 volt constant potential circuits are as follows, viz:

1 horsepower, $48 per annum; 2 horsepower, $96 per annum; 5 horsepower, $180 per annum; 8 horsepower, $240 per annum; 10 horsepower, $300 per annum; 15 horsepower, $450 per annum; 20 horsepower, $600 per annum.

We operate a total of 832 motors, of which 196 are fan motors, 1,396 arc, 135 Bernstein and 200 Swan incandescent lamps. One motor circuit contains 26 miles of outside wire and 394⅛ horsepower "C. & C.," one 2 horsepower and one 4 horsepower Brush motors, and is run with a No. 8 Brush arc dynamo. We have one 40 K. W. 500 volt "C. & C." generator in service, on an eight mile circuit, with 48 horsepower in motors in use, the ammeter averages 29 amperes. We experience no difficulty in running same with our power. The twenty-six mile motor circuit is the most popular circuit we have, and is run through the north-east suburban portion of the city. All the motors on this circuit, with a few exceptions, are placed in tailor shops that are either in the dwellings or in shops built in the rear of the dwellings.

The rebate for poor service during the year ending December 31, 1890, was one one-hundredth of one per cent. of the gross receipts, and the uncollected accounts for the same period was one-tenth of one per cent. of the gross receipts.

The Edison Electric Light Company have recently erected a three-story stone station at the foot of the upper Genesee Falls, on the west side of the river, and have at present two double discharge Leffel mining wheels under about 90 feet head, giving 600 horsepower, and are placing two more of 400 horsepower each. In addition, they have a fine steam station in the center of the business district. Incandescent 16 candlepower lamps are furnished at one cent per hour; arc lamps for city use, 28½ cents per night; municipal incandescents at six cents per night. The latter they are partially replacing with arc lamps. They have in circuit 105 arc, 805 municipal and about 13,500 16 candlepower incandescent lamps.

The Rochester Electric Light Company's plant is situated at the upper Genesee Falls on the east side of the Genesee River, near the business center of the city.

The station is three stories in height from the top of the Falls, with the wheel pit underneath, blasted out of solid rock 95 feet in depth. They have five Leffel horizontal turbines, four are 23 inches, and the other 30½ inches in diameter, with a total of 1,500 horsepower, under a head of 86 feet and 8 inches.

The penstock is a steel pipe seven feet in diameter; the power is transmitted to five shafts 80 feet above by belts 173 feet in length, running at a speed of 7,200 feet per minute.

The dynamo room is directly over the shafting, from which all of the dynamos are belted through the floor. The dynamos are the United States system. They have in service 325 city arc and 140 commercial arc lamps; also 1,500 incandescent lamps and two 10 horsepower motors. They have just placed one 85 horsepower generator and one 1,500 light Westinghouse alternating dynamo.

As a reserve power, they are putting in a 400 horsepower engine. The city lights are being furnished at 27 cents per light.

In addition to those I have mentioned, there are five incandescent plants and one arc isolated plant run by waterpower in Rochester, some 500 incandescent and 25 arc lamps, making a grand total of 1,991 arc and 16,640 incandescent. The population of Rochester is 135,000, making a very high average per capita.

DISCUSSION.

Mr. Redman: We have two motor services—one running in the northern portion of the city, and the other in the northwestern district, where, with very few exceptions, the motors are placed in dwellings or in small shops built in the rear of dwellings. Heretofore the small manufacturers resident there have done business in the center of the city, and on the fifth or sixth floors of buildings, but now they do their manufacturing at home, either in their dwellings or in small shops.

As a boss tailor remarked to me the other day, when he did his work down in the city he only worked himself, but now, said he, "mine frau and all the children work."

MR. ARMSTRONG: We get 39 cents for 2,000 candle power lights every night, and all night, while here the price is stated by Mr. Redman as 27 cents for city arc lights. I see that for commercial lighting, all night and every night, forty cents per night is obtained by this company, which only has to use coal for half a day during the whole year. The facts shown by these figures, as they go out, ought to be strongly emphasized, and the fact ought to be just as strongly emphasized that nothing but water power is used by this company. And the further fact ought to be emphasized that in addition to the fact that the water power cost nothing so far as the electric light is concerned, 2,500 horse power is sold. So that the incidental expenses, as I apprehend, and possibly the investment itself is paid for by the sale of water power in addition to the sale of electric lights.

MR. REDMAN: You will notice that two other companies charge the same price. There are three companies doing business there.

MR. ARMSTRONG: And practically you get the same price. Are they also using water power?

MR. REDMAN: Both water and steam.

MR. ARMSTRONG: My purpose in rising was simply to call attention to the fact and to impress it upon our minds, that these differences in figures are due to the fact that the water power in Rochester furnishes the original power at almost if not nominal cost.

MR. FRANCISCO: Do you make any difference with regard to the business you are running.

MR. REDMAN: No, sir; not unless it is used for ventilating purposes. Where a one horse-power is used for ventilating purposes we get $120. It is for constant service. We do not use any meter.

MR. FRANCISCO: My experience is that there is a difference in the business. I am running at the present time a 30 horse-power motor, and running an entire factory with it. In that factory they have a Daniel's planer, and that takes 44 amperes to run it. When they first started I could not understand what was going on down there. They would throw on the 44 amperes of current, while their motor was not intended for such an arrangement. I went down and investigated the matter, and found that it all depended upon the way they were running that planer. They would set it for a quarter inch strip, and put on the 44 amperes, whereas if they would set it for an ordinary work, it would only take 40 amperes with a 500 volt current. The point was just here: that in doing their planing, if they took only a thin shaving they have got to run the board through twice, whereas if they take a thick shaving they run it through but once, and it takes but half the time. We charge the same rate for light and power—25 cents per thousand watts. But we have found in respect to its use for power that there is a vast difference in the kind of business in which the power is used. We are running a motor for a daily paper. They used to run that paper with water power and a steam engine, and it took them four or five hours to run off an edition. We started in, and they supposed that it would take the same length of time to run off the edition with our motor as it did with the water motor and engine, and we based our contract upon that supposition. They have found, since they put our motor in, that it requires just one hour and ten minutes to run that edition through, instead of four or five hours. Our contract, however, was based on the experience which they have had with the water motor. They only used the motor while that edition is being run off,—for the one hour and ten minutes; whereas, in another class of business, as in running an elevator, they will run the motor through ten hours of service. In one store they are running a passenger elevator, a freight elevator, a cash system, and a coffee grinder—all with the same motor, and they are running it for ten hours. They run it under a contract. If we charge for horse-power so much for ten hours service, of course, in that case we would lose; whereas, in another case, where we charge by the horse-power the motor might not be in service half the time. So you see that there is a vast difference in the employment, so far as the motor business is concerned. We are also running a freight elevator in a store, which is run on a meter. In the first place the man was afraid of the meter, and said that he would prefer to make a contract for a specified sum. He said that he had had some experience with meters—and, by the way, he is a director in a gas company. So we made a contract with him for the motor, but for my own information I put a meter in. At the end of the first month he paid his bill according to the contract. When I went then to look at the meter at the end of the second month he said, "Of course it is nothing to me, but how much does that meter indicate?" Said I, "It would cost you just one-third of what you are paying." I charged him $60 per year for a five horse-power motor. I find that as to other classes of business it is the same. I find that a job printing office is one of the very worst places you can get into.

MR. LEONARD: Mr. Francisco states that he charges 25 cents per thousand watts. I want to ask him what he means by that.

MR. FRANCISCO: A thousand watts is 746 watts in horse-power. When a man uses 1000 watts he has used a horse-power and a fraction beyond that. When he has used 1000 watts he pays 25 cents. That is our rule.

MR. LEONARD: That is a pretty heavy charge, I think, for power,—it is 12 cents per hour.

MR. FRANCISCO: But remember that we are running on steam power, where coal costs us $4.50 per ton. And here is another picture: The entire installment is under our care.

MR. WILMERDING: If we could get the rate of 25 cents per thousand watts we should prefer the meter; but I have found the meter system unsatisfactory, because the character of the service varies so much. Our charge for elevator service is from five dollars per month to fifteen dollars. That is on the basis of ten cents per thousand watt hours. On our contract prices we make three rates: We have a rate for continuous power, a rate for intermittent power, and a rate for elevator service. For the elevator service we charge $5 per month per horse-power, or $60 per year. That is for any kind of elevator service. But I have never found that any of those elevators when run on the meter show more than one-third of what our contract price would give us. I have also found that our customers are more surprised than we are at the small price they have to pay for the service. For that reason I have concluded recently that we will not furnish any elevator service on the meter. [Laughter.] We do not want to surprise them in that way. That comes to about six cents per horse power.

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On the other hand, the low first cost of an alternating system, the simplicity of its circuits and of the operation of the central station, and its ability to reach with moderate expenditure of capital, lighting at any practical distance, make it the only possible pioneer in new and untried territory without great risk and almost the certainty of expending capital which will never be remunerative.

Hence it is, that we find the three-wire system in possession of the densely settled centers of

cities and towns, and not extending to the outskirts because of the uncertainty of a sufficient return upon the necessary capital, and both the central station manager and the distant would-be consumers anxiously awaiting the development of improvements which will enable the three-wire central station to supply such distant consumers. And hence it is, that the manager and consumers of an alternating system anxiously await the day when motors can be operated and a more economical, safe and reliable current than the present alternating current can be furnished by such a station to supply the imperative wants of the heart of a busy city.

If the above statement of the present existing conditions be a fair one, it will be evident that if we could only in some way secure the advantages of both systems in a common distribution, we should greatly improve matters. The object of this paper is to point out what appears to the writer to be a step forward in that direction.

The following conditions seem to be necessary.

1. We must supply a continuous current for the central portion of a town during the daytime when power is required.

2. We must supply the outlying districts with an alternating current during the night time when lighting is required.

3. We must not operate the alternating system under conditions of light load when its efficiency is very low.

4. We must be able to supply current for lighting continuously throughout the 24 hours of the day.

5. We must have but one set of conductors in any consumers' place.

In order to meet the above conditions I propose the following:

1. Wire all consumers upon the standard three-wire systems.

2. Connect all consumers upon standard three-wire mains.

3. Arrange the network of mains so that the central section of the network can be disconnected from the outlying sections through the agency of switches.

4. Install three-wire feeders to supply the central portion of the systems at full load, and install 1,000 volt primary wires and alternating current converters with a three-wire secondary circuit to supply the outlying section at full load.

Let us see how we will operate the station. Suppose it is eight o'clock in the evening. The switches which serve to connect the central and outlying sections are open, and our three-wire plant is supplying the full load of the central portion of the city. The alternating plant in the same central station is supplying the converters of the outlying section, which convert from 1,000 volts primary to 220 volts in the secondary, and the secondary coil has a connection at the center which is led off to supply the central wire of the three-wire system of the outlying section, the outside terminals of the secondary being connected to the outside wires of the three-wire system. It will be noticed that both plants are being operated at full load.

Now, suppose it to be eleven o'clock. The load has gone off rapidly so that the alternating plant is now operating under the worst possible conditions, and these conditions will continue for the outlying district until dusk the next day—that is for probably 18 hours. An operator is now sent out who goes to each section supplied by a converter, and by throwing a switch transfers the secondary wiring from the alternating system to the three-wire mains. In this way the small remaining load is gradually transferred to the three-wire plant and then the alternating plant is shut down. The three-wire plant continues in operation all night and all the next day, supplying all devices with a continuous current. Motors can be operated in all portions of the system even for domestic purposes in the distant residences, and all consumers get the opportunity of the use of the continuous current for any purpose desired for 18 hours out of the 24.

Dusk now arrives and soon the heavy lighting load will rapidly come on, and in such case the outlying section could not be supplied by the small wires feeding the distant three-wire section during the day, which are only about one tenth the size which would be necessary to supply the full load.

The operator again goes round the circuit and now transfers the load of the outlying section from the three-wire plant to the alternating plant and this condition prevails again until eleven o'clock arrives, when the operation is repeated, as before described.

The switches for transferring the load of the outlying section from one system to the other, can readily be controlled by simple means from the central station itself, if desired

Now, let us look at some of the advantages we have gained.

All of our inside wiring is done on the three-wire systems for use of a lamp of 110 volts. This means that for the same distance and loss in conductors, we will save eleven-twelfths of the cost of copper which would be required by a secondary using 55 volt lamps upon a two-wire system; or to put it another way, we can supply 110 volt lamps upon a three-wire system with the same cost of copper, and the same percentage of loss in conductors at three and a half times the distance which would be permissible for 55 volt lamps on a two-wire circuit.

We all know the great desirability of using large converters, on account of their cheaper first cost per lamp and their higher efficiency, and also because a far more perfect regulation of pressure can be obtained upon a lot of lamps scattered in different kinds of store throughout a block, if they be supplied from one converter, than can ever be obtained by supplying these lamps by a lot of small converters loaded differently in almost every case, and consequently supplying a different pressure at the secondary terminals of each converter. Under the system proposed by me one converter would ordinarily supply the entire lighting of a block, resulting in less first cost, higher efficiency of conversion, longer life of lamps, greater reliability and greater simplicity of plant.

A point worthy of notice is that for 18 hours out of the 24 an absolutely safe pressure is in use throughout the entire system, and that during all daylight hours when the greatest liability to accident from contact with high pressure wires exists, no high pressure is in use.

With such a system no consumer need be turned away.

The consumer who wants to charge storage batteries, and also make electric welds by electricity, can do so upon the same day and from the same wires that supply his incandescent lamps.

The factory upon the outskirts of town, which runs its isolated plant, and must to-day either use storage batteries or run machinery all night to supply a few watchmen's lights, can now switch on to the central station at six o'clock, and operate the few lamps it may need untill dusk next day, when heretofore the alternating system, which was the only one which could reach it, did not run after midnight; or possibly after day-break, because of the loss of money in so doing.

With this system the outlying districts can be pioneered with the least first cost and least risk. Any outlying section in which, for any cause, the demand increases greatly beyond that originally anticipated, can be supplied permanently by the three-wire system by merely running the necessary feeders to supply the already existing mains, and in such case the switches and converters would be moved out further or transferred to some new section ready for pioneer work.

The combination of a storage battery system and an alternating system also presents peculiar advantages. The storage battery is at its best when supplying a small steady load, such as we have for at least 16 hours out of the 24. The alternating is at its best when supplying the full load possible only during the remaining eight hours. The average electrical load on a general system is only about 12 per cent. of the maximum, consequently we are entirely safe in the statement that the greatest load during the 16 hours of light load is not more than 10 per cent. of the maximum load for the 24 hours.

If we were to attempt to operate the heavy load by storage batteries, we must either make an enormous investment, or, what is even worse, operate storage batteries at a disastrous overload. On the other hand, if we try to operate the 16 hours light load with converters, our efficiency, when operating at ten per cent. of our converter capacity, would be unmentionably low. But reverse the case and everything works at its maximum efficiency. During the eight hours of possible heavy load,we operate all devices by the alternating system. At the same time a continuous current dynamo charges our storage batteries located either in the central station, or, if more desirable, at different centers in the system of distribution. At the end of the 8 hours' run we shut down the plant, lock up the station, and leave it for 16 hours, the storage batteries meantime supplying all devices.

If, for extraordinary reasons, we have not capacity sufficient in the storage batteries to supply the demand, we run the continuous current plant to assist it; and if that should fail or prove insufficient, we start up our alternating current and supply all or a disconnected part of the system with it.

With this plant distances are of no consequence; we can use 1,000 volts for the continuous current plant as well as for the alternating, and the single two-wire distribution is all that is necessary for perfect results.

The weak spots of this latter arrangement will, no doubt, be thought to be the storage battery, but my experience with this device is that if you use it properly under suitable conditions, and do not attempt to squeeze impossible results out of it, economical and satisfactory service can be obtained from it, and certainly no better conditions could be obtained for it than those described above.

Up to this time a bitter fight has waged between those believing that the alternating, the direct, or the storage battery system, respectively, was the only suitable one.

I believe in them all, each operated so as to be used under the best conditions for its use, and I trust that the suggestions given above may lead to our being better able to meet and overcome our common enemies: High First Cost, Low Efficiency, Danger, Unreliability and the Inflexible Conditions of the existing demand.

DISCUSSION.

T. Carpenter Smith: I think if there is one feature in our business which has been overlooked it is the relation with which we are most concerned, and that is the relation which it bears to the public. We have been accustomed to speak of the efficiency, the reliability, the safety, the easy adaptability of any of the various systems in use, only with reference to the relation that those features bear to the central station itself. The consequence has been that all currents using high tension have almost without exception in the first years of the business been installed, in such a manner as to be a serious menace to life and property, and therefore have been universally condemned by the uninitiated public. I wish, therefore, to say that whatever remarks I may make are based upon the relation of electric lighting to the public, and not its relation to the central station. With that statement as a starting point, I wish to join issue at once with Mr. Leonard in his statement that the alternating system suffers by comparison with the three-wire system, "for its efficiency is much lower, its reliability is less due to the fact that its machines are not practically operated in multiple arc, its safety is necessarily less due to the existence of the high primary pressure, and its current is not adaptable to commercial use for motors, charging storage batteries, electro deposition, etc." I will start out at once with the first of these—as to its efficiency being much lower, and will say that the efficiency from the standpoint of electrical engineering, the average efficiency during the twenty-four hours load, the converter system as at present installed may be lower than that of the three-wire system. But with regard to the satisfaction of the public, I think that the efficiency of the alternating system is considerable higher. I have been operating now for nearly four years an alternating system, and we supply three thousand lights in a district of the area of six city squares. We cannot go any further because we cannot get a franchise. Our district is honeycombed by the three-wire system. Their central station is within a block of us. Their wires run down every block on which ours are found, and on some blocks where ours are not. They have connections in nearly every building in that district, and yet they have never succeeded in taking a single light from us. On the contrary, we have taken several customers from them, simply on the ground that their customers could not stand the poor regulation. We have never lost a customer from bad service. We have thrown several off but we have never lost one. Mr. Leonard says that "its reliability is less, due to the fact that its machines are not practically operated in multiple arc." I do not think that that amounts to anything, and for this reason: That while the machines are not generally operated in multiple arc, still they can be, and if there were any necessity for it they would be so operated. I do not think there is any necessity for it, and I prefer not to do it, because I think that in case of accident to any one machine there is far less danger of accident to others. Any one machine being broken down does not give you the risk of breaking down other machines running on the same circuit. The time required to throw in the switch of a relay machine is not more than the time which is required to throw in the switches which Mr. Leonard uses for transferring from one system to the other. In actual practice that simply amounts to the winking of the lights for one instant. Another advantage, and one in which safety is also concerned, lies in the fact that the alternating system has its load divided up into small units. That is to say, no matter how badly the wiring may have been done in any one building, it does not affect any other building, and one customer cannot threaten the

safety of every other customer of that station by having his apparatus or the wiring in bad condition. The failure of one group does not affect any of the others. The alternating current in itself, from the mere fact of its being an alternating current, has an immense added safety in the fact that it will not strike an arc. It is difficult to produce an arc with it except under very high pressure. A very serious question, which was brought before the committee on safe wiring, is one that we have got to face before very long, and to consider seriously, and that is the grounding of the neutral wire. There have been several arguments brought forward why this should be allowed. It practically came down to this, that the insurance agents and inspectors have preferred to ground the neutral wire, and practically make a return to the one wire system of installing electric lights, to avoid the much greater danger of the 220 volt arc between outside wires, and the consequent damage in buildings where combination fixtures are used. Now I do not know whether it is not a good thing to go back to the one wire system of wiring. That is an engineering question that we shall have to determine by years of experience. But I do know that if the grounding of the neutral wire is permitted, you must also permit the grounding of the transformer. You cannot make fish of one and flesh of the other. And, more than that, I do not believe that is the real reason of the desire for the grounding of the neutral wire, but that it is rather due to the fact that any failure of the third wire would cause the blowing out of the lamps on one side or the other, according as the load may be placed. That objection would equally apply to Mr. Leonard's plan of wiring up all lights on the three-wire system. I think that the inherent defects of the three-wire system are enough to forbid its use. The two-wire system will meet these conditions. You can do your wiring on that system, if you please, on one hundred volts although I think myself that the lower voltage we get and the larger conductors we get, the better safety we get—and the slightly additional cost in installation is generally borne by the consumer. The statement that with large converters we get cheaper first cost, higher efficiency and better regulation of pressure, I fully agree with. I will speak of that later on when I come to point out the method of alternate distribution which I think meets all the points that Mr. Leonard desires. The statement that the safety of the alternating current is necessarily less, due to the existence of the high primary pressure, I beg to deny. The three-wire system in use gives an absolutely continuous metallic connection between dynamo and lamp, from street main to lamp, and from every lamp on a circuit to every other lamp on that circuit. Those employing three-wire systems, finding that they could not operate their street circuits with any economy, have installed high tension machines, carrying considerably higher voltage in many cases than the ordinary alternating system. It is very evident that the first contact between that high pressure wire and the street main at any point, however slight it may be, puts that high tension on every lamp on that circuit. To do that with the alternating system, you have to break down the insulation of every converter. Personally I have never known of a case of contact between the primary and secondary coils of a converter. I know that such have occurred, but I do not think that there has ever been one worth considering when we think of the enormous number of converters that have been put into service, the immense strides that have been made by the alternating system, and the small knowledge we had of it when we first started to install it. There are accidents which will teach us lessons, but which should not lead to a condemnation of the new system. The high primary pressure we must have, no matter whether we use the continuous or the alternating current. We cannot carry the current otherwise. It is exactly the same as with water pressure or with steam pressure. Twenty years ago fifty pounds was considered high steam pressure. To-day, eighty pounds is the average. I do not think that any new boilers that are being installed more than twenty-five per cent. are being put in for a pressure of less than one hundred and fifty pounds, and in ten years one hundred and fifty pounds of steam pressure will be used where eighty is now used, and two hundred pounds where one hundred and fifty are now used. We know that in all new stations that are being installed, in all new plants where steam is being used for power, the constant tendency is to raise the pressure. It is kept safe simply by the addition of proper precautions due to the increased pressure. The statement as to its current not being adaptable to commercial use for motors so far would seem to be proved, but four years ago that same argument was brought forward that the current could never be used for meters. I think that the alternating current meter has pretty well fought out its own case and worked out its own salvation. I do not think that to-day there is any direct current meter on lines in which they are in use which can compare with the meters which have been brought forward as the direct result of the introduction of the alternating system. I therefore think that in a few years we shall see the motor in the same way. We do have a demand however for power, and so far we must admit that the alternating motor, except in small sizes, is not well adapted for use for certain central stations. I think, however, the experience of every central station is, that it is better to have separate circuits for power and for light. And I think that this plan will meet fully all the requirements of the central station, and that you can use the alternating current for your lighting and the continuous high tension constant potential circuit for your motors. That constant potential circuit can also be used for charging storage batteries and for any of the other purposes for which the direct current is used. The safety to the consumer by the use of convertors is not only limited to the accidents from the system itself, but it also has its value in the case of light installations. Not long ago there was a discussion between the advocates of the direct and of the alternating currents at which one of the advocates of the direct current called attention to the fact, and gave it as a warning against adopting it, that the converter was simply a good lightning arrester to protect one company at the expense of the other, and one alternating current advocate present had the good sense to rise at once and thank him for the advertisement. I do not think that there is any stronger argument which you could use for its adoption. The people who are operating stations presumably know what they are about. They know that they are handling a dangerous element, and they will take care of it. Their employees should be well instructed, and then if an employee is injured it must be due either to his own carelessness or to those accidents which must, to a certain per centage, always happen. I think that when you sum up the disadvantages of the alternating system you will bring it practically down to one, and that is poor efficiency on low loads. To meet that, a system must be devised which will have all the advantages of the alternating system, and which will have an efficiency practically the same at high load as at low load. At high load I think that the efficiency of the transformer system is as nearly perfect as we are likely to get it. The further improvements will come in by the use of better material and of greater care in manufacturing. With these improvements I think it will pretty nearly reach the coveted advantages. The thousand-volt primary current which is in ordinary use, is not high enough for large cities. Ferranti uses 10,000 volts, and has been operating under that current for several months and with apparently great success. I think there is no doubt that the time must come when we will use higher pressure than one thousand volts at central stations, and then get right out in the outskirts where we can have cheap fuel or water power, and from there send into the city under high pressure the whole current, taking off nothing on the way, that we will have sub-stations where the current will be reduced from very high pressure which must not be handled at all—to a lower pressure midway between the generating pressure and the distributing pressure, and with that we can supply the districts. In the substation it will then be possible to install three or four large converters—or any number that may be required—connecting them up in multiple arc, and then when the load gets light, instead of changing over to another system we will simply cut out some of those converters on both ends, leaving only fully loaded converters to carry the load. This, of course, is open to the objection that it requires the presence of an attendant, but devices have been made and are in operation in England whereby that change is made from the central station by means of automatic switches which can throw in one, two, three, four or five of those large sub-converters. I do not believe in the use of small converters. I think the larger you can keep your converters the better, but yet we have to weigh very carefully the disadvantage of having too few lights on one converter and too many lights in one group where by grounding of one part of the group you may affect the safety of another part. It is between those two limits that we must fix upon our most efficient sizes of converters. The same rule holds in figuring up the sizes of conductors. In figuring up the size of blast pipes used in our large rolling mills, and in the size of water mains, that question is continually coming up, and the limits on one side are the interest on the extra money expended in the first place, and the loss by friction, or by resistance, or by pressure, or whatever it may be. The use of the two systems in this way, by keeping all the customers continually wired up upon an alternating system, avoids great danger of connection between your high tension wires and your low tension main. If your high tension wires get crossed with your high tension direct wires for the supply of power, the station may be hurt, but the consumer is not likely to be. Say what you will, it comes down to this—that it is the consumer who will regulate the running of your station. If he does not regulate it by legislation he will do it by hurting your business, by refusing to take what you supply under arbitrary conditions. And so we come back to the proposition with which we started—that no corporation, individual or government, can say "The public be damned" and not suffer for it.

Mr. Leonard: Mr. Smith seems to have made the error of assuming that I am appearing in the role of an advocate of the three-wire system. If such an impression exists I wish to correct it as promptly as possible. My remarks with reference to the three wire systems and the alternating were such that they would be admitted by almost every one to-day. I presume that any one familiar with the facts would admit that the average efficiency of the three-wire system was higher, that it was conspicuously higher at small loads, and in speaking of the possibilities and advantages of the system which I have proposed I was only giving consideration to the existing conditions of to-day. First, I will speak upon the points that Mr. Smith has mentioned, as I have noted them. He spoke of the disadvantages of operating the multiple arc, and yet it seemed as though the universal opinion must be that a multiple arc arrangement of dynamos is preferable to a separate one when we remember that in the first part of the business of electric lighting, machines of constant potential were operated on separate circuits, and that they have been gradually placed in multiple arc is due to the advantages gained thereby. I think you will almost never find to-day an isolated plant where we have a large number of machines supplying a constant potential distribution, in which each machine is supplying a separate circuit.

The possibilities of regulating and the economies are so much higher when machines are in multiple arc that, entirely outside of any consideration of central station supply or of the three-wire system, it seems as though the result of experience has been that, where machines can be operated perfectly, simply and reliably with multiple arc it is better to do so. With reference to the question of grounding the neutral wire, I can dismiss that by stating that I agree thoroughly with Mr. Smith that the grounding of the neutral wire is extremely bad practice, and that there is no argument for grounding the neutral except perhaps that of laziness. As to the high pressure primary, the paper which I have read of course bears evidence in itself that I am a thorough believer in the necessity of high pressure primaries for reaching any great distance, and there certainly appears to be an advantage in having those high pressure wires as few in number as possible. And instead of having a complete network through the city of high pressure wires, if we can by any means get a few of the high pressure wires to centers there would be less liability to any trouble due to the existence of high pressures. Mr. Smith has mentioned that in his belief an alternating current motor will soon be attained in practice and ready for service. I thoroughly agree with Mr. Smith on this point, and have no doubt that an alternating current motor will soon be ready for commercial service,—but how soon is a question. In the meantime the condition to-day is that the central station manager cannot secure an alternating current motor to put upon existing circuits, and in fact the work which is being done on an alternating current motor thus far is not of a kind to indicate that an alternating motor which can be placed upon the same circuit as an incandescent lamp will result. One point I will state before going further: all of my remarks have been on the basis of the three-wire system merely because of the saving in the cost of conductors, which is attained thereby. Were we able to have a two hundred volt lamp instead of 110 volts, it would be of course infinitely preferable to have the two-wire system and use a 200 volt lamp than to have three wires for a lamp of 110 volts on each side, and furthermore the cost would be reduced even beyond that of the three-wire system. As to the sub-station's method of operating on the outskirts of the town, that is unquestionably, when the alternating current motor is at hand, a very desirable way of operating. And yet it seems to

me that even there, until we have our 200 volt lamp, it will be extremely advantageous to use for distribution something which will enable us to reduce the cost of our conductors on the consumer's premises, to a point far below that of 50 volt lamps. As I have pointed out in the paper the cost, at the same distance, and at the same percentage of loss in conductors, the cost of a three-wire system will be but one-twelfth of that of a two-wire system with 50 volt lamps, and if we had 200 volt lamps with the two-wire system and our secondary distribution, it would be but one-sixteenth. Consequently, when we have delivered our high pressure to the sub-station and are ready to distribute to our consumers, we would have to have a very large number of sub-stations in order to operate 50 volt lamps, or else we must have an enormous expenditure in conductors. It seems to me that under the existing conditions it will be well, and indeed the best way that we have at present at command, to use the three-wire system, as it does enable us to distribute from that center at low pressure and at the least cost. When the time comes that the 220 volt lamp is commercial the three wire system will, of course, present the advantage of being able still to reduce the cost, but the high pressure which will be realized then may be a sufficient argument against the use of 500 volts in the premises of the consumer, and may make the 200 volts satisfactory.

MR. SMITH: I wish to speak first in reply, because I wish to straighten out a little matter between Mr. Leonard and myself which might interfere with the proper carrying on of the discussion afterwards. I fully understand Mr. Leonard's attitude in this matter. My remarks about the three-wire system were not made with any idea that Mr. Leonard is upholding it as against the alternating, but because he, in his new plan, calls for all inside wiring to be done on the three-wire system for lamps of 110 volts, I apparently did not make it clear that the 200 volt direct current in the building is what the insurance people are afraid of now, and that consequently we must abandon that in any new system which is to be an improvment upon that. The use of an alternating current of 220 volts I do not believe would have that disadvantage, and in that case Mr. Leonard 's plan would be all right. But as his plan contemplates using part of the time a current of 220 volts I feel that the 220 volts should be barred altogether. Of course on a 55 volt lamp we can use the three-wire system, and in many cases where buildings have already been wired, we may get a proportion of reduction of copper in that way. With regard to the multiple arc I would say that in my experience the multiple arc in isolated work has been used to save the running of new feeders. Where a plant has been wired up throughout, and one dynamo installed, and then enough lights put on to take up the whole capacity of that machine, and the customer wants more light, he taps the wires which he has. But when he goes to put on new power he simply couples his new dynamo right into the bus bars, just as a man who puts in a new boiler in a steam plant couples in the old steam pipe. If the old steam pipe were too small he would run a new main. And so it is with an electric light plant. Where we install an isolated plant we always put it so that three or four dynamos can operate, though as a general rule they are all in multiple arc. Another reason for operating in multiple arc is found in the fact that small units have been hitherto made in machines. A thousand light dynamo is about just so far good for practical use but we have 3000 light dynamos for the alternating current, and larger ones are to be built and used. In that case I do not think that there can be any question about multiple arcing. With regard to sub-stations I would say that Mr Leonard seems to have slightly misunderstood me. The sub-stations are not for the purpose of direct supply to the consumer. They are for supplying the sub-mains which are run at much higher pressure than we would introduce to the customer, and the customer is supplied through a second series. That of course gives us the double conversion, and the loss caused by double conversion as against the loss caused by a single conversion, but it gives us the advantage of running one of those converters always at its highest efficiency, namely, a full load. The whole question of course, as I have said, comes back to one of interest on first cost as against loss in feeders. So that in speaking of sub-stations I do not mean to be understood as saying that there would be an enormous number of sub-stations, but only one for each district, very much the same way as Mr. Ferranti is now operating in London. We have been looking very anxiously for the completion of that station. He is a very young man and has taken hold of the problem in a way calculated to alarm a great many older heads, but his own personal energy and constant overlooking of every detail is such that I think we cannot give enough praise for the succes that he has made at his station. He is handling there pressure which we never dreamed of ten years ago. I well remember when on the floor of this convention 10,000 volts were spoken of as being carried through the country on a line of poles it was thought that it should have a deadline 100 feet each side and which if any tramp crossed it it would be a good thing if he were killed. And yet Ferranti is carrying such a line through the streets of a crowded city, and nobody knows anything about it and, as a rule, the less the public do know about such things the better.

MR. LEONARD: I think that Mr. Smith has made a very ingenious argument upon the multiple arc question, but I hardly feel that his position is sustained by the facts or by practice. Of course, as he has pointed out, where conductors are placed on one dynamo, and the load gradually increased, they are driven to the multiple arc arrangement, unless they are going to put in new conductors. The fact is, that every large isolated plant that I have ever had occasion to bid on, has been so specified and rated by the common consent of all companies that have entered bids, that the dynamo shall be multiple arc when there were eight or ten at the beginning, and it is the universal practice in all companies to so design their plants; and, hence, the multiple arc arrangement is one that has been forced by the unexpected enlargement of the plant rather than by a deliberate design to obtain the best results in the beginning. Mr. Smith has spoken of an arrangement of sub-stations; but he has not yet pointed out how to get rid of the losses that will occur upon the final converters. He has put an intermediate set of converters in, and has taken means to take out converters as the load diminishes; but his final converters in his distribution throughout the city are still connected, and are the same as we have had before.

T. CARPENTER SMITH: I would use the same plan as Mr. Leonard proposes in his system. I would have them grouped and switched in and out by the operator, just as I do in the substations. I am only comparing one system against the other. With regard to the multiple arc, I will say that I still hold to my proposition that multiple arcing is not put in because it is a great advantage, but it is put in to allow of two machines being connected together. It is a good thing simply because in an isolated plant the conditions are different from what they are in a central station.

MR. LEONARD: Mr. Smith explained how he was going to reduce the loss of the final converters of the circuit by throwing off a part of the load when the load became too heavy. This necessarily assumes an arrangement of converters in multiple arc on the secondary, which is not contemplated in my scheme, and is not in practice to-day.

MR. BELL: At the risk of stirring up all parties in this discussion, I want to make one or two suggestions with regard to this scheme, and the first of them is to suggest the question as to whether or not a 220 volt alternating circuit is a pleasant thing to have around the house. I have very grave doubts about that. I am not afraid of the direct current or of 220 volts straight current; but when it comes to turning loose 220 volts on a three-wire system, alternating around and about the house, it seems to me that it is a good thing to avoid. I know that there are plenty of alternating current men who say that they have no fear of a current of 1000 volts. But in all seriousness I think that 220 volts alternating current is a thing which has got to be handled rather delicately if buildings are to be customarily wired for it. I do not know that there would be any risk to life from 220 volts alternating current; but at the same time I think the public would view the matter with a little doubt. As to the question of alternating currents I think that we ought to remember that on the other side of the water alternating currents are habitually run for the purpose of keeping the whole system loaded to its fullest capacity. We do not happen to do it here; but they do make a practice of it over there, and with great success. As to the reason for it I think it is all summed up in the saying that it is a good thing not to put too many eggs in one basket. If you have a one hundred kilo watt machine, and anything happens to it, the whole station is demoralized until the machine is fixed. If you have three or four smaller machines you may be able to crowd on a load and thus keep going. But I have heard grave doubts suggested by those who know Ferranti personally as to whether he will ever complete those machines. There is such a thing as getting an alternating current so big that you cannot handle it efficiently, and I think that those units of Ferranti come very near that.

MR. T. CARPENTER SMITH: I have brought a good deal of unpleasant newspaper comment upon myself by certain statements that I have made in public, but I have made those statements, and I am prepared to stand by them, and every experience that I have had since making them has only confirmed my belief. For the whole public I cannot speak, but for a certain small section I can speak. We did have --but have changed them all for other reasons -- several buildings in which we had 220 volts of alternating current. The buildings had been originally wired for the three wire systems but with very small wire. We had to make the change rapidly and could not take time to increase the size of the wire. We took four 50-volt converters and coupled the primaries in multiple arc, and put secondaries in each system, and put them across the three-wire system. We found that our customers did not object half as much to the 220 volt shock of the alternating current as they did to the 220 volt direct. The shock is undoubtedly a great deal more unpleasant and for that reason I think it is rather a good thing, for it discourages the use of the multiple current which the customer is only prone to indulge in. The real danger to life I think must not only be taken into consideration is from shock, but the far greater danger, from fire. We have no hesitation in saying, and we do not think there is any insurance man here present who will not agree with the statement, that the danger of fire from an alternating current of 220 volts is not ten but one hundred times less than from 220 volts of the direct. Another thing: our three-wire stations have developed in practice (although I doubt if any of them would admit it in public) a very easy, but very reprehensible practice of burning out their grounds at night. When they discover a ground upon the system they find it easier and cheaper just to slip in three or four big machines, and let her go, and they will find out where the ground was next morning. That is pretty bad as regards the danger to life, and I think very much greater than any chance of any accident arising from a 220-volt shock. I am not contending for 220 volts of alternating current. I do not like it myself. I am only pointing to the fact that as compared one with the other, if 220 volts of direct has not been found dangerous or objectionable, the 220 volts of alternating will not be found so.

MR. ORFORD: In Bridgeport for three years we have been running the three-wire system. and we have had 3,000 lights in operation. The question of danger we know nothing of. We have never had any trouble whatever in that way. We have had a few fuses blown, as every person has had, but as for fires, we have never had any. We are able to distribute the current from the dynamo to a distance of three-quarters of a mile - giving us a pretty large district in which to distribute the current. But we found that we had some outlying districts that we were not able to reach, and then we began to inquire into the question of putting in an alternating plant. The only way I could make inquiries was to go around to central stations and try to find out what they were doing. I would go to the manager of the central stations in the several towns, and when I talked with him, so long as he thought that I was a stranger to the business he would represent the matter as being eminently successful in every respect, but when I came to asking him a few leading questions they would sometimes turn and ask me why I asked the questions, and who I was. One question I put to them was this: "Have you been able to displace gas altogether?" They said "No, certainly not." "Do you advise your customers to take their gas fixtures out?" "No, what would we do that for? What would we do if anything happened to our lights?" I found that that information was sufficient for me. I found that the alternating system with them was not even an alternating one, but that you had to alternate it with gas. There was one gentleman that I asked the question of who had had experience with both the direct and alternating systems. He said that the only thing he could say for the alternating system was that it was very destructive. It certainly had no advantage, that he could state, over the direct system, except that you could go further with it, but when you attempt to go further with it you have to put in just about as much wire as you would under the other system. Then you have on the other hand the continuous watch to keep upon your converters. With our 600 light machine, that was the point that I carefully watched, but as our maximum increased, say up to 12 o'clock, we would have a ratio of one-third increase right straight along. Even if these converters had no lights on them

they would still run one-third at a loss. Of course we inquired into the cause of this from the parties who had sold us the apparatus, and incidentally one of them admitted that it was due to the converter. But he thought better of that afterwards, and he had some one sent down to explain that this slowing up after twelve o'clock, although it indicated amperes, yet it took no power. I rather doubted the assertion, and so I made the test, and found out that it did take power. We are so satisfied with the continuous current in Bridgeport that it has been adopted in New Haven and some other places. They have an alternating system in New Haven also, but it is the occasion for many complaints. It may be that the complaints are due to the fact that they are not able to operate it. I think that in Philadelphia, where Mr. Smith is able to give better service than the man with the continuous current machine, he must have a very poor manager for his competitor. I think that I could wake them up a little bit. I do not think that you would see any variation in our light at eight o'clock in the morning. We put our machines in, and they go from 100 amperes on each side, up to 1,000, and I defy any one to tell when we put a machine in or when we take it out. We are running what may be called a bastard machine. Of course we are not under the Edison patent. We are forced to steal our devices, or contrive them for ourselves. As for such things as regulators, as you call them, we have none of them. It would be impossible to keep our lights at equal pressure all over the system by usual means, but we have a method of our own by which we are able to do it, and so satisfactorily that our customers are not putting in any gas pipes. We have dry goods stores where they are paying out from $2,000 to $3,000 per year for light, and they have no gas in the buildings. Their meters are gone, and the gas fixtures have been taken out. We have not paid in the shape of rebates five cents in five years, and we have had no customer say to us that our lights were out for five minutes. As to the cost of running, we are not able to tell anything about it except that when our customer puts out his lights we do not use any more power, and when he puts out his lights on the alternating current there is just as much lost on the machine as there was before he put them out. That may be a little exaggerated, but it is in that direction. Now with regard to the fuses, we took the fuses out of the secondary altogether, and we took them out of the primary also so far as they related to the converters, and we adopted the plan of having a switch, and in the switch box there is a fuse which is connected directly from the main. So if we have occasion to do anything with a converter, we can disconnect the circuit with it entirely. We have had no trouble with converters. We have had quite a number of them in operation for over a year, but have had no trouble with them. I am surprised that we have had so little trouble. We took the precaution of grounding our circuit at the terminals and at various points in the center. There is one thing which I have found out about the alternating system, and that is that it is not able to take care of itself. It generally wants some one to look after it. We had a man cut down a tree, and the tree fell across our mains, and brought two wires together. The wires fell to the ground, but the customers knew nothing about it. The other day we had two wires come together in one branch of our primaries. It was a stormy evening, and it crippled the whole service on that branch. We had a fuse in, and fortunately the machine was able to blow the fuse. But an alternating machine is not able to rise to such a necessity as that. I will say, also, that my idea of fuses has never altogether met the approbation of the insurance people. I do not quite believe in copper wire because it takes a high heat to melt it, and I do not believe in putting in a small fuse. I do not like a single fuse put in below ten amperes. Ten amperes is not a very large amount of current. We never use less than No. 18 wire. We have had no trouble whatever in that direction. I would say in conclusion that so far as we have gone, we see the necessity of both the continuous current and of the alternating current, and we do not think that any station is complete without both.

T. Carpenter Smith: Replying to the last speaker, I would say that this is simply an individual case where, by first class management, he has got a first class station and I would say in his case, as I said in the case where I was asked to select the manager for an alternating station, that I would not ask for any better man to run an alternating station, because he has shown that he can handle a central station, no matter what it is, whether direct or alternating.

With regard to the people telling him that they have not advised their customers to take out the gas, I would ask him if direct companies do as a rule advise their customers to take out the gas. On our station of 3,000 lights we have seven newspapers, and four of those papers have not had gas used in their building for about four years. One of our customers is the Franklin Institute, in Philadelphia, which has its drawing school and library open every night. The day we put the light in they took all their gas fixtures out, and they have not had them in since. We installed an isolated plant that was put in on the central station plant in Philadelphia, two years ago, of 250 lights in the Spreckles Sugar Refinery. Before that time Mr. Spreckles had been using the direct system. His refinery has been running night and day since the 19th of September, two years ago, and in that time he has never lost a light nor has his plant cost him one penny to run, as he has told me more than once. We advised that no gas pipe be put in, and there has not been a foot of pipe put in that building. I may mention that estimates for piping that building for gas were $1,500 more than his entire electric light plant cost him; including boilers, engines, wire, dynamo and everything complete. The question whether your light will be reliable or not, has a great deal to do with the way in which it is run and the system used, and I think that is a point which is not nearly enough considered. For every station using alternating currents which has put in direct current apparatus afterwards, I think we can show a dozen that first had the direct and put in the alternating afterwards. The two systems have their uses undoubtedly. The point I wish to make is that I believe for lighting purposes you can do just as much with the alternating system when you have spent one-half the time and one-half the money on it that has been spent in bringing the direct current system to its present perfection.

Captain Brophy: I do not wish under any circumstances to take sides in this discussion. I do not think it would be proper for me to do so. Perhaps I have had as much experience in watching the good and bad points or seeing the good and bad points of both systems, as anyone, owing to the position I have held. It would be very unfair for me to give to the public the weak spots in any one system, if I know them. They both have their good qualities. I only wish to say one thing in regard to the matter of fuses. I have studiously insisted on increasing the size of fuse. The system of using a certain size for a given number of lamps has caused a great deal of trouble and annoyance. As a rule, in the central stations the fuses are altogether too small. They should never be below the safe carrying capacity of the wire, and in 95 cases out of 100 they are, except, perhaps, in our own territory, where I have insisted on their being increased.

As to the matter of fire, I wish to say here that the losses from fire by the introduction of the electric light system has been too insignificant to take notice of. It is true that it is said that one of the largest fires in Boston for years was caused by the electric light. There are certain officials all through the country to-day, some of them are more ornamental than useful, whose duty it sometimes is to determine the cause of a fire, and they very often know very little about it. In years gone by the standard cause of a fire when no other cause could be assigned was spontaneous combustion or matches. Now it is electric light wires. I trust that all you gentlemen see that you install your wires as carefully in the future as you have in the past and improve on them.

Mr. Burleigh read the following paper:

Uniformity in Method of Keeping Central Station Accounts.

BY J. J. BURLEIGH.

The National Electric Light Association partially fills its mission by bringing together, twice a year, central station managers and others interested in the production of light and power, but notwithstanding the very valuable paper of A. R. Foote, read at the Niagara Falls meeting, and the papers of Messrs. Smith and DeCamp, read at the Kansas City meeting, absolutely nothing has been accomplished towards a uniform system of accounts or a classification of expenses.

All, I am sure, feel the very great necessity for a more comprehensive and uniform system of accounts,

A system that will show the exact cost per unit of their output,

A system that, being kept uniformly by all, will give managers an opportunity of comparison with each other.

This knowledge of cost per unit of output is particularly felt at this time, since nearly all central stations are in direct and active competition with other illuminating companies and with other means of supplying power.

At present no two keep their accounts alike, hence, comparison with each other is out of the question.

The principal function of accounting is to bring out the fact that the average cost of certain items of expense per unit of output in one station exceeds the average cost per unit of the same items of expense in another station, and the accuracy of these averages depends entirely on the uniformity of accounting. Great differences in these averages would prompt an inquiry as to the cause, and if the circumstances did not warrant higher averages, steps could be taken to reduce the cost of these particular items.

To make these comparisons of any value to those desiring to make use of them, a uniform classification of accounts should be adopted, and to insure accuracy, the different items of expense, chargeable to the different accounts, should be specified.

The operating accounts proper embrace the current working expenses and the cost of keeping in good order the original plant.

The company with which I am connected have classified their accounts as follows:

Chargeable to	Arc Lighting	Incandescent Lighting	Power St. Cars	Power Stationary	Total
Boilers, repairs of					
Belting, "					
Boiler House and Stock, repairs of					
Carbons					
Clerks					
Converters, repairs of					
Dynamos					
Dynamo Attendants					
Enginemen and Firemen					
Engines, repairs of					
Fuel					
General Officers' Salaries					
Horses, Wagons and Harness					
Insurance					
Interest on Notes, Bonds and Mortgages					
Incidentals					
Instruments of all kinds					
Lamps, repairs of					
Lamp Supports and Fixtures					
Lamp Globes					
Lamps, Incandescent					
Linemen					
Labor at Stations					
Labor on Street Cars					
Loss and Damage					
Legal Expenses					
Meters, repairs of					
Motors "					
Oil					
Office expenses, repairs and furniture for					
Poles & Lines, maintenance & renewals of					
Right of way					
Station, repairs of					
Stationery and Printing					
Superintendent and Foremen					
Steam Piping, repairs of					
Shafting, "					
Taxes, City					
Taxes, State					
Tools, repairs and renewals					
Trimmers and Inspectors					
Water					
Waste					

All expenses that are naturally or entirely charged to either arc lighting, incandescent lighting or power, are entered in their respective columns; expenses that are not entirely charged to any one service are apportioned on horse power output basis, making the division as between arc, incandescent or power, in the proportion which the horse power used for each bears to the total horse power output.

For the proper division of those accounts not chargeable entirely to any one of the principal departments; for example, the total output of the station being 1,000 horse power; the company operating 500 arc lights, 2,500 incandescent lights and 250 horse power for power, the division of a bill for boiler repairs, engine repairs, fuel and similar divisible accounts, would be ½ arc lighting, ¼ incandescent lighting, ¼ power.

The division to be accurately determined each month.

No intelligent economy can be practiced without a thorough knowledge of the cost in the past and a comparison of the same with the present outlay. Constant comparison of accounts tends to economy. The experience of other companies is a good guide and would be found of great utility.

I would like to urge upon the convention the importance of the adoption of some uniform classification of expenses that they can recommend to central station managers for their adoption.

It does not follow that central station managers are to expose their books in detail, but to so prepare their accounts that they can give the secretary of the National Association replies to such questions of cost per unit as would be proper to exhibit to the other members.

Such statistics would be of the greatest interest and value; indeed, it would be of more value than all the other papers combined.

I have a station producing arc and incandescent light and power, earning a moderate dividend for its shareholders, but I have nothing to guide me as to how my expenses per unit compare with other central stations. I would give much for such information.

Therefore, I conclude that this is one of the

CAMDEN LIGHTING AND HEATING CO.

Statement of Expenses for.......................189.... .

Heads of Accounts	Arc Lighting	Inc. Lighting	Power — St. Cars	Power — Stationary	Total
Boilers, repairs of					
Belting, "					
Boiler House and Stack, repairs of					
Carbons					
Converters, repairs of					
Clerks					
Dynamo, repairs of					
Dynamo Attendants					
Enginemen and Firemen					
Engine, repairs of					
Fuel					
General Officers' Salaries					
Horses, Wagons and Harness					
Insurance					
Interest on Notes, Bonds and Mortgages					
Incidentals					
Instruments of all kinds					
Lamps, repairs of					
Lamp Supports and Fixtures					
Lamp Globes					
Lamps, Incandescent					
Linemen					
Loss and Damage					
Labor at Station					
Labor on Street Cars					
Legal Expenses					
Meters, repairs of					
Motors					
Oil					
Office Expenses, repairs and furniture					
Poles and Lines, repairs and renewals					
Right of Way					
Station, repairs of and furniture for					
Stationery and Printing					
Superintendent and Foremen					
Steam Piping					
Shafting					
Taxes, City					
Taxes, State					
Tools, repairs and renewals					
Trimmers and Inspectors					
Water					
Waste					
Total Expenses for Month					

Total average arc lights, ... Total inc. output in ampere hours, ...
Total arc light hours, ... Total as shown by meters, ...
Total cost per arc light hour, ... Total loss, ...
Total cost per 100 ampere hours, ...
Total stat'y power output in watt hours, ...
Total as shown by meters, ...
Total loss, ...
Total cost per 1,000 watt hours, ...

REMARKS.

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most important subjects that can engage the attention of the Association.

After the discussion of Mr. Burleigh's paper the convention adjourned to the following day.

Fire Department Display.

The members of the National Electric Light Association have very clearly defined ideas of how to combine pleasure with business in their conventions, and they were nothing loth to do justice to the generous provisions that the city of

CAMDEN LIGHTING AND HEATING CO.

General Statement of Earnings and Expenses for Month of.......................189....

EARNINGS — From	189....	189....	Increase	Decrease
Arc Lighting				
Incandescent Lighting				
Power—St. Cars				
" Stationary				
Miscellaneous Sources				
Total				
Net				

EXPENSES — Expenses of	189....	189....	Increase	Decrease
Arc Lighting				
Incandescent Lighting				
Power—St. Cars				
" Stationary				
Total				
Net				

Earnings and Expenses, Showing Net Earnings

From all Sources	Gross Earnings	Expenses	Net Earnings
Month of			
Same month last year			
Increase			
Decrease			
Jan. 1st to			
Same period last year			
Increase			
Decrease			

DR. BALANCE SHEET CR.

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Respectfully submitted, ...*Secretary*.

Burleigh Method of Station Accounts.

Montreal made for them in this respect. The display of the Fire Department on the Champ de Mars drew a large attendance of visitors. The general evolutions of the parade elicited loud applause, and there was some especially good work done at different periods of the display. These were quickly recognized by the electricians, who were brim full of good humor, and whose spontaneous expressions of approval and appreciation, often racy and vigorous, were all the more pronounced from the absolute muteness which seemed to pervade the undemonstrative Canadian element of the crowd.

Montreal can be congratulated on having a fire brigade on which it can confidently rely when its services are called into requisition.

CAMDEN LIGHTING AND HEATING CO.

Comparative Statement of Expenses.

Heads of Accounts	Month of 189..	Month of 189..	Increase	Decrease
Boilers, repairs of				
Belting, "				
Boiler House and Stack, repairs of				
Carbons				
Converters, repairs of				
Clerks				
Dynamo, repairs of				
Dynamo Attendants				
Enginemen and Firemen				
Engine, repairs of				
Fuel				
General Officers' Salaries				
Horses, Wagons and Harness				
Insurance				
Interest on Notes, Bonds and Mortgages				
Incidentals				
Instruments of all kinds				
Lamps, repairs of				
Lamp Supports and Fixtures				
Lamp Globes				
Lamps, Incandescent				
Linemen				
Loss and Damage				
Labor at Station				
Labor on Street Cars				
Legal Expenses				
Meters, repairs of				
Motors, "				
Oil				
Office Expenses, repairs and furniture				
Poles and Lines, repairs and renewals				
Right of Way				
Station, repairs of and furniture for				
Stationery and Printing				
Superintendent and Foremen				
Steam Piping				
Shafting				
Taxes, City				
Taxes, State				
Tools, repairs and renewals				
Trimmers and Inspectors				
Water				
Waste				
Total Expenses for Month				

COMPARATIVE STATEMENT OF OUTPUT.

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REMARKS.

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....*Secretary*.

Burleigh Method of Station Accounts.

Thursday's Proceedings.

At the session Thursday morning the following paper, by Captain Eugene Griffin, was presented:

Three Years' Development of Electric Railways.

BY EUGENE T. GRIFFIN.

The first recorded description of the electric car is found in the fourth verse of the second chapter of Nahum: "The chariots shall rage in the streets; they shall jostle one against another in the broadways; they shall seem like torches, they shall run like the lightnings."

Notwithstanding this early mention, it was not until 1888 that the electric railway became a practical commercial success. I fix the date at 1888 as it was in that year that Bentley and Knight opened the Allegheny City road to regular traffic; that the Sprague Company equipped the Richmond road, and the Thomson-Houston Co. installed the Eckington and Soldiers' Home road in Washington. It was in 1888 that railway officials began to realize the possibilities of this new tractive force; that the great West End system of Boston adopted electricity to the exclusion of cable, and that orders began to flow in upon the electric companies for street car motors to such an extent as to soon make the manufacture of such motors one of the leading branches of the electric industry.

Previous to 1888 electric motors had been used on several roads. Some of these roads were doing well and have been prosperous since; but to the public these were experiments on a comparatively small scale, and did little to inspire general confidence. The early inventors found it difficult to secure adequate financial backing; orders were few and business unprofitable. The stronger companies which took up the work in 1888 had the organizations and capital necessary to achieve success.

The pioneers who devoted their brains and frequently their purses to this work previous to 1888 are deserving of all credit. It was their misfortune, not their fault, that their ideas were not developed and worked out commercially. It is difficult for one man to combine the qualities of inventor, manager, superintendent, seller, expert, and financier, and yet this is what Van Depoele, Daft, Bentley and Knight and others had to attempt. The record of their efforts is an interesting one, but the chronological record of electric traction has been so frequently given that it would be a waste of your time to repeat it again.

There are, however, one or two of the early trials that are specially worthy of consideration, not only because of what was actually accomplished, but principally on account of their bearing on later developments. On the 27th of July, 1884, an electric car was running scheduled trips over a mile of track of the East Cleveland Street Railway Co. in Cleveland, Ohio. This was the first electric car in regular operation on a street railway track in the United States. The motor was placed between the wheels and supported from the car body, and geared to the axles by belts of spring wire cables. The current was conveyed to the car by conductors supported on insulators in a small wooden conduit, and connection made with the conductors by means of a plow extending through the slot to the conduit. This was the initial installation of the Bentley & Knight system. Mr. Bentley has a photograph of the car in his office in Boston.

The road was given up in 1885, and the Bentley-Knight works transferred to Providence, R. I. After various experiments the road in Allegheny City was begun in the summer of 1887. The cars were started during the winter of 1887-8, although the road was not formally opened to traffic until February, 1888. Four cars were furnished to this road which, I believe, are still running. On the lower end of the road was a mile of double track conduit which was continued by an overhead system of about five miles. The conduit was on a long grade of about 12 per cent. Over-running trolleys were used with the overhead system. The conduit was in operation for two years or more, but has now been taken up and replaced by the overhead system.

As early as 1874, while C. J. Van Depoele was engaged in Detroit, experimenting with electric motors, generators, etc., it occurred to him that trains of cars, and even ordinary street cars, could be run by electricity. This was demonstrated to the satisfaction of his associates in various ways, but no public exhibition was made until 1883. When the Chicago elevated railway was under consideration, it was proposed to demonstrate the feasibility of utilizing electricity as a motive power. A track 400 feet in length was built, with a 5 per cent. grade in the centre. One car was equipped with a 30 h.p. motor and ran for several weeks with considerable success, carrying crowds of people. This was in February, 1883. In the same year an elevated railway car was operated electrically at the Chicago Inter-State Fair. The car was suspended from the truck instead of being mounted on it, and was in operation during the entire exposition—some fifty days.

During the Toronto Annual Exhibition in 1884, an electric railway some 3,000 feet long was operated from the entrance to the grounds to the main building. This was a conduit road and the wires carried a potential of over 1,000 volts without an accident. A thirty horse-power electric locomotive was used hauling trains of cars.

The Van Depoele Company subsequently equipped roads at Minneapolis, Minn., Montgomery, Ala., Detroit, Mich., Windsor, Ont., Appleton, Wis., Port Huron, Mich., Scranton, Pa., Lima, O., Binghamton, N. Y., Ansonia, Conn., Dayton, O.,

Jamaica, N. Y., St. Catherines, Ont., and elsewhere, many of which are still in operation.

In the fall of 1887, Frank J. Sprague contracted for the electrical equipment of the Union Passenger Railway at Richmond, Virginia. This was an important road in a large city, and Mr. Sprague's undertaking was the most ambitious effort in this direction up to that date. It is worthy of note that Sprague's original intention was to use motors with but one reduction, but he was forced to abandon this idea as none of the electrical companies at that date were able to produce single reduction motors. The motors used at first were too light for the work, the copper brushes scored the commutators badly and were rapidly consumed. Nevertheless, Mr. Sprague persevered and in 1888, despite all obstacles, the road was running with so much success that it was one of the object lessons which induced Henry M. Whitney and his brother directors of the West End Street Railway of Boston to adopt electricity as a motive power when they were already far advanced in the plans for cabling their system.

As nearly as can now be ascertained the following electric roads were actually in operation on January 1, 1888.

ROADS.		LOCATION.	MILES.	NO. OF MTR. CARS.
Union Passenger Railway Company	(Daft)	Baltimore, Md.	2.00	3
Windsor Electric Railway	(Van Depoele) opp.	Detroit, Mich.	1.25	2
Appleton Electric Railway	do	Appleton, Wis.	5.50	5
Port Huron Electric Railway	do	Port Huron, Mich.	2.75	4
Highland Park	(Fisher)	Detroit, Mich.	3.25	4
Scranton Suburban road	(Van Depoele)	Scranton, Pa.	5.00	12
Los Angeles Electric Railway Company	(Daft)	Los Angeles, Cal.	5.00	6
Lima Street Railway & Motor Power Company	(Van Depoele)	Lima, O.	4.00	8
Columbus Consolidated Street Railway	(Short)	Columbus, O.	1.00	2
St. Catherine's Street Railway Company	(Van DePoele)	St. Catherines, Ont.	7.00	12
Seashore Electric Railway Company	(Daft)	Asbury Park, N. J.	4.00	18
San Diego Street Railway Company	(Henry)	San Diego, Cal.	3.00	9
East Harrisburg Passenger Railway Company	(Sprague)	Harrisburg, Pa.	4.50	10

A total of 13 roads, 48.25 miles of track and 95 cars.

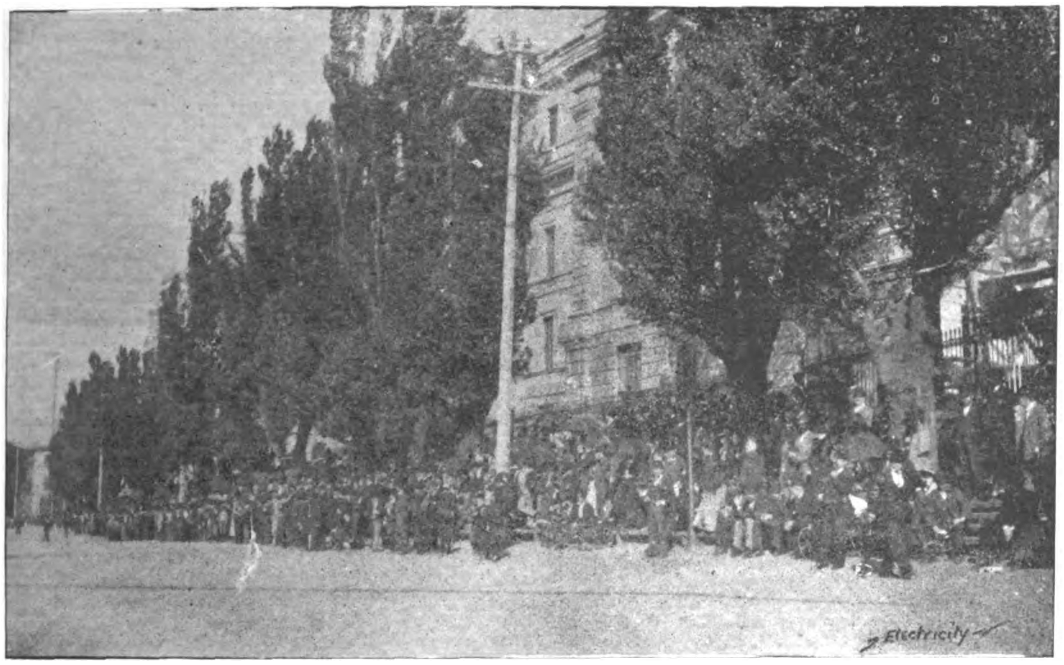
On July 1, 1891, there were 354 roads in actual operation, with 2,893 miles of track equipped electrically, and 4,513 motor cars. Such has been the growth of three and a half years.

This development has been marvelous and unprecedented. Referring to it, General Francis A. Walker said to me, not long since, that it seemed as though at least thirty years normal development had been crowded into three years.

It has indeed been a fruitful period, and the progress has been so rapid that the public are just beginning to appreciate the benefits which science has conferred upon them by the adaptation of the electric motor to street car propulsion.

During the past spring the legislature of the State of Massachusetts was considering a proposition which practically amounted to the imposition of new taxes upon the West End Street Railway Company, and the abrogation or virtual annullment of certain vested rights which the company might claim. In his able and vigorous defense of his corporation, President Whitney was forced to investigate and determine the true relations which exist between his company and the public, and he was surprised to see how closely the welfare of the city of Boston and its surrounding suburbs was identified with the welfare of its street transportation system.

He at once entered upon a "campaign of education," and his speeches in Somerville, Roxbury, Dorchester and elsewhere (several of which have been published in pamphlet form) are masterly, impressive, straightforward and convincing presentations of the close relations which exist between the rapid transit systems and the health, wealth, morality and prosperity of our large cities.



WATCHING THE FIRE DEPARTMENT EXHIBITION.

I commend these speeches to the consideration of you all. I have not hesitated to draw from them largely myself.

I consider this growing realization of the true position which transportation companies occupy in respect to the public, as one of the most important of recent developments, and it may be well to give it some consideration.

The officers and directors of a street railway company are quasi public officers with most important and serious duties devolving upon them. Their duty to their stockholders is to see that the company is economically and efficiently administered so as to produce a fair return upon the capital invested. Their duty toward the public is to see that the best possible transportation facilities are afforded, having in view "the greatest good of the greatest number." This broad statement of their public duty is unquestionably true, and yet the failure to appreciate this axiom is the most fertile source of adverse criticism of railway management. The critic almost invariably argues from a personal standpoint. If he would only remember that the road is run for the benefit of the masses and not for his personal individual benefit, the lives of general managers would be made less burdensome.

The last census has clearly shown a strongly-marked tendency of our population to gravitate toward the large cities. In every state the percentage of growth in cities is far greater than in towns and villages. Such condensation of population means an increase of the tenement house system in contradistinction to the cottage system, a crowding of people beneath each roof, an increase in vice, immorality, misery, crime and the death rate. How is it to be avoided? The laborer must live near his work, near in time and near in money. He can spare but a fraction of his time, but a fraction of his day's wages in going to and from his work. If the zone fare system exists as in Europe, the area in which he can live is limited by this consideration. Two cents per mile might restrict him to a radius of 2½ miles (5 cents). If the single-system prevails as in this country, time is practically the only restriction. Let us assume that he can allow thirty minutes morning and evening for his car ride, paying five cents for each ride. At the rate of six miles per hour, fast for horses, he has a radius of three miles and an area of 28¼ square miles within which to select a home. At the rate of nine miles per hour, slow for electricity, he has a radius of four and a half miles and an area of 63½ square miles within which to select a home. This example suffices to illustrate the point. An increase of only three miles per hour in rapidity of transit doubles the available residence area without increasing the time or expense of the laborer in going to and from his work.

The steam road, the elevated road, the underground road and the cable, each and all afford rapid transit; but their application is restricted within very narrow limits because of their great cost, while the electric roads can be profitably extended in all directions.

The great advantage of increasing the available residence area, of encouraging the cottage system and discouraging the tenement system, will be readily conceded by all. The health and morality of a great city are invariably proportional to the number of people beneath each roof. The Electric Railway is one of the great moral agents of the nineteenth century.

The experience of the past three years has settled many disputed questions, resolved many doubts, systematized methods and improved construction.

A variety of styles, systems and methods were used prior to 1888. We had storage batteries, conduits and overhead wires; single trolley and double trolley wires, over-running trolleys and under-running trolleys.

Storage batteries have made little progress. They have nowhere scored a pronounced success, and have been abandoned on nearly every road. They are but little considered in the field of electric traction, except in reference to future possibilities.

The very few conduits built have disappeared and have been replaced with overhead wires. The overhead wire is now generally recognized as the only practicable method of conveying electricity from the generator to the car motor.

The objections to overhead wires have been, and in many places still are, very strong; but actual experience has shown that the objections are not well founded. Wires are not an ornament to the street, and objections on this ground will always exist; but lamp-posts, signs, railway tracks, and many other similarly useful objects are not ornaments. Overhead wires will never be condemned on this ground alone. Objections on the score of unsightliness become of less and less importance each year as the methods of construction are improved and the public appreciate more fully the benefits of electric motive power.

One of the early apprehensions in reference to the use of overhead wires was the possible danger to life from the current used. On this point I think the public are now well satisfied. While there are few employees on any of the roads now in operation who have not had the full shock of 500 volts repeatedly, there is not a single instance of any of the patrons of these roads who have been killed or even seriously injured by the 500 volt current from the overhead wire. Electric cars will run over and kill the careless pedestrian or the drunken passenger who falls from the platform in front of the wheels as will the horse car, but no passenger or pedestrian has ever been killed by the trolley wire, and statistics do not show that the electric car is in any respect more dangerous to life than the horse car or cable car. Last year (1890) the West End Street railway system of Boston carried 114,853,081 passengers and all the steam railroads of the whole state of Massachusetts only carried 98,843,712. The West End system killed 15 passengers and employees and the steam roads killed 325. Of the 15 fatal accidents on the West End system, 5 were attributable to electric cars and 10 to horse cars. It is only fair to say that the narrow and crooked streets of Boston and the enormous traffic of the

West End system are conditions peculiarly conducive to accidents.

The fear of the electric current is one born of ignorance and time alone can overcome it.

In the year 1889, nine human beings were killed by the arc light wires in New York City (2,500 volts) and the authorities were roused to such a pitch of frenzy that the poles were chopped down and a large part of the city left in darkness. Yet with perhaps one exception all of the victims were employees of the lighting companies and suffered because of failure to observe proper and well-known precautions. In the same year, twelve persons were asphyxiated by gas and over thirty were killed by signs and other objects falling on their heads as they walked peacefully along the streets.

In time we are able to estimate every danger relatively, but in the beginning unknown dangers, those to which we are not accustomed, are greatly exaggerated.

Ralph W. Pope, in a very interesting paper read before the Franklin Institute last year gives some curious illustrations of this tendency to magnify unknown dangers and arrest the progress of improvement. I quote:

"In an article, entitled 'How our Ancestors Travelled,' we find the following pertinent observations on the subject:

"Carriages met with great opposition at their first introduction, and laws were made to suppress their use. As early as the year 1294, Philip the Fair, of France, issued an ordinance for suppressing luxury, in which the wives of citizens were forbidden the use of carriages. Beckmann tells us that there is preserved in the archives of the County of Mark, an edict, in which the feudal nobility and vassals are prohibited from using coaches under pain of incurring the punishment of felony. Duke John, of Brunswick, published an order in 1588, roundly rating his vassals for neglect of horsemanship, and forbidding them to appear or travel in coaches. A few years after this, the English Parliament took up the discussion of the subject; but on the 7th of November, 1601, the bill to restrain the excessive use of coaches within the realm of England was rejected. But the bitterness of antagonism to them did not cease with this legislative decision. In a pamphlet called the 'Great Concern of England Explained,' published 1673, the writer very gravely attempts to make out that the introduction of coaches was ruining the trade of the realm. Following is an example of his method of reasoning: 'Before coaches were set up, travellers rode on horseback, and men had boots, spurs, saddles, bridles, saddle-cloths, and good riding suits, coats and cloaks, stockings, and hats, whereby the wood and leather of the kingdom were consumed. Besides, most gentlemen, when they travelled on horseback, used to ride with swords, belts, pistols, holsters, portmanteaus and hat cases, for which in these coaches they have little or no occasion. For when they rode on horseback, they rode in one suit, and carried another to wear when they came to their journey's end; but in coaches they ride in a silk suit, silk stockings, beaver hats, etc. and carry no other with them. This is because they escape the wet and dirt, which upon horseback they cannot avoid; whereas, in two or three journeys on horseback these clothes and hats were wont to be spoiled; which done, they were forced to have new ones very often, and that increased the consumption of manufacture.' In another part of his pamphlet, the same writer puts the following query, evidently with the notion that it was a clincher: 'Is it for a man's health or business to be laid fast in four ways; to ride all day with strangers, oftentimes sick, diseased, ancient persons, or young children crying; all whose humors he is obliged to put up with, and crippled with their boxes and bundles?' As an additional objection against the introduction of coaches, the writer urges that they would discourage the breeding and lessen the value of horses.

"The following passage occurs in a protest against the construction of railways, which is preserved in the archives of Furth of the Nurnberg Railway, which was the first line constructed in Germany. It was drawn up by the Royal College of Bavarian Doctors:

"Travel in carriages drawn by a locomotive ought to be forbidden in the interest of public health. The rapid movement cannot fail to produce among the passengers the mental affection known as Delirium Furiotum. Even if travelers are willing to incur this risk, the Government should at least protect the public. A single glance at a locomotive passing rapidly is sufficient to cause the same cerebral derangement, consequently, it is absolutely necessary to build a fence ten feet in height on each side of the railway."

These were all European, however, so in order to assure you that these peculiar views were held in our country, the following protest from the good citizens of Philadelphia, in 1833, against the introduction of gas, will be of interest to you:

"*Philadelphia, November, 28, 1833.*

"Remonstrance Against Lighting with Gas.

"To the Honorable, the Select and Common Councils of the City of Philadelphia:

"Gentlemen:—

"The subscribers beg leave to respectfully remonstrate against the plan now in action for *lighting the city with gas*, as they consider it a most offensive, inexpedient and dangerous mode of lighting. In saying this they are fully sustained by the accounts of explosions, loss of life and destruction of property where this mode of lighting has been adopted.

"We consider gas to be as combustible as gunpowder and nearly as fatal in its acts; as regards the immense destruction of property, we believe that the vast number of fires in New York and other cities may be in a great measure ascribed to this mode of lighting. The leakage of pipes and carelessness of stopping off the gas, furnish almost daily instances of its destructive effects. And when we consider that this *powerful and destructive agent* must necessarily be left often to the care and attention of youths and domestics and careless people, we only wonder that the consequences are not more *appalling*. It is also an uncertain light; sometimes suddenly disappearing and leaving streets and houses in total darkness.

"The waters of the Delaware and Schuylkill, now considered the most pure and salubrious in the world, as many long voyages have fully tested, must soon, we fear, experience the deterioration which has reduced the water of the Thames to the present impure state, for no reservoir will be able to contain such fetid drains from such an establishment, and very soon the rivers must be their receptacle, to the destruction of the immense shoals of shad, herring and other fish, with which they abound; the same cause must produce the same effect. Salmon, smelts and other fish, formerly caught in vast quantities in the Thames, have nearly all disappeared. The constant digging up of the streets, the circumstances of the gas pipes, which, at the intersection of each square, must come in contact with the water pipes, are difficulties and evils which we would anxiously avoid.

"In conclusion, we earnestly solicit that the *lighting our city with oil may be continued*.

"And your petitioners, etc.

"Signed by 1,200 of the leading citizens of Philadelphia, whose names are attached hereto, such as Horace Binney, Hartman Kuhn, Jacob Ridgway, Paul Beck, Henry Pratt, Benjamin Chew (on whose farm the battle of Germantown was fought), John Sargeant, Charles Wharton, Richard Willing, Edward Pennington, Robert Baux, Joshua Longstreath, Matthew Newkirk, and 1,200 others.

"N. B. The above are only part of the names, as many of the remonstrances have not yet come in."

The double and single trolley systems have each had ardent advocates, but three years' experience has decided the question in favor of the single trolley and the ground return.

In July, 1888, several roads were using the over-running trolley and it was a question whether the over-running or under-running system was preferable. Three years have decided this question also, and practically all of the electric roads of to-day operate with under-running trolleys. The "fish pole" of 1888 has been supplanted by the neat steel rod of 1891, and the "broom-stick train" can no longer be spoken of with disrespect as regards outward appearances.

Three years have not passed without much litigation and already we have historical cases finally determined, which tend to fix the legal boundaries of the rights of electric railways. Some of these decisions are of great importance.

The telephone companies have quite naturally been ardent advocates of the double trolley, and to avoid suffering from the induced currents of the single trolley, they have sought to induce the courts to compel railway companies to use metallic circuits. A recent decision of the Supreme Court of the State of Ohio, is a fair statement of the present legal aspect of this question.

Single Trolley System vs. *Double Trolley.*

(Supreme Court of Ohio.)

SYLLABUS.

1. The dominant purpose for which streets in a municipality are dedicated and opened, is to facilitate public travel and transportation, and in that view, new and improved modes of conveyance by street railways are by law authorized to be constructed, and a franchise granted to a telephone company of constructing and operating its lines along and upon such streets, is subordinate to the right of the public in the streets for the purpose of travel and transportation.

2. The fact that a telephone company acquired and entered upon the exercise of a franchise to erect and maintain its telephone poles and wires upon the streets of a city, prior to the operation of an electric railway thereon, will not give the telephone company, in the use of the streets, a right paramount to the easement of the public, to adopt and use the best and most improved mode of travel thereon; and if the operation of the street railway by electricity as the motive power tends to disturb the working of the telephone system, the remedy of the telephone company will be to re-adjust its methods to meet the condition created by the introduction of *electro-motive* power upon the street railway.

3. Where a telephone company, under authority, derived from statute, places its poles and wires in the streets of a municipality, and in order to make a complete electric circuit for the transmission of telephonic messages, uses the earth, or what is known as the "ground circuit," for a return current of electricity; and where an electric street railway afterwards constructed upon the same streets, is operated with the "Single Trolley Overhead System" so called, of which the ground circuit is a constituent part, if the use of the ground circuit in the operation of the street railway interferes with telephone communication, the telephone company, as against the street railway, will not have a vested interest and exclusive right in and to the use of the ground circuit, as a part of the telephone system.

The telephone companies have been beaten in every case, and the fact has been definitely settled that railway companies may use a single overhead trolley wire and a ground return without infringing any rights of the telephone companies.

Many interesting legal questions have arisen in reference to line construction.

Objection was made by the summer residents of Newport to the construction of an overhead electric railway, and eminent counsel was employed to place every possible legal obstacle in the way. The case was carried to the Supreme Court of the State of Rhode Island for determination of some of the novel points involved, and one of these points was:

Are Poles and Wires an Additional Servitude upon the Streets?

The Court held:

"The fourth ground alleged is that, if the act of incorporation authorizes the use of electricity for the operation of said street railway, and the erection of the poles as ancillary thereto, it is unconstitutional and void, because it authorizes the imposition of additional servitude upon the streets without providing for any additional compensation to the owners of the fee of said streets. We think it is settled by the greater weight of decision that a railroad constructed in a street or highway and operated by steam in the usual manner imposes a new servitude and entitles the owner of the fee to an additional compensation; but that a street railway operated by horse power, as such street railways are ordinarily operated, does not impose any new servitude, and does not entitle the owner of the fee to any additional compensation.

"The distinction is not often stated as a distinction between steam and horse railroads; but the distinction properly rests not on any difference in motive power, but on the different effects produced by them respectively on the highways or streets which they occupy. A steam railway is held to impose a new servitude, not because it is operated by steam, but because it is so operated as to be incompatible with the use of the street in the other usual modes, or, in other words, so as practically to exclude the usual modes of use.

"A steam railroad on a street, so operated as to be consistent with the use of the street in the usual modes, has been held not to impose a new servitude.

"It is not the motor but the kind of occupation, whether practically exclusive or not, which is the criterion.

"The only considerable privilege which the horse car has over the other vehicles, is that of being confined to its tracks, it cannot turn aside for other vehicles, while they are forced to turn aside for it; but this is an incidental matter, insufficient to make the horse railroad a new servitude.

"The street railway here complained of is oper-

ated neither by steam or horse power, but by electricity. It does not appear, however, that it occupies the streets or highways any more exclusively than if it were operated by horse power.

"Reference has been made to cases which hold that telegraph or telephone poles and wires erected on streets or highways constitute an additional servitude, entitling the owners of the fee to additional compensation; and from these cases it is argued that the railway here complained of is an additional servitude, by reason of the poles and wires which communicate its motive power. There are cases which hold as stated, and there are cases which hold otherwise, but, assuming that telegraph and telephone poles and wires do create a new servitude, we do not think it follows that the poles and wires erected and used for the service of said street railway likewise create a new servitude. Telegraph and telephone poles and wires are not used to facilitate the use of the streets where they are erected for travel or transportation, or if so, very indirectly so; whereas the poles and wires here in question are directly ancillary to the uses of the streets as such, in that they communicate the power by which the street cars are propelled."

In the purely technical field all obstacles have been overcome. Like Perry, "We have met the enemy and they are ours." The severe strain imposed by railway work on the generating plant has necessitated the development of new types of engines and the fluctuations of the dynamos have been prevented by the compound winding. Self-regulating dynamos are now considered necessary in any well-planned power plant.

I attended the exposition at Bremen in North Germany, last summer, and had the pleasure of riding on an electric railway operated by two 80 h. p. Thomson-Houston dynamos. One dynamo was driven by a 70 h. p. Armington & Sims engine and one by a 125 h. p. German engine. So closely did the small American engine regulate that no variation in potential could be observed under the most violent and sudden variations in load. Notwithstanding its greater power the German engine was slow to respond and the variations in speed were marked. I was subsequently informed that a medal was awarded to the American engine, although it had not been entered as an exhibit.

This is indicative of the enterprising way in which the inventors and manufacturers of the United States have met the new conditions imposed by the adoption of electricity as a motive power.

The difficulties Mr. Sprague encountered in Richmond in using copper brushes have now deen avoided by the introduction of the carbon brush, for which we are indebted to Mr. C. J. Van Depoele.

As early as 1883-4 Van Depoele used carbon brushes with his motors. When the Van Depoele Electric Manufacturing Co. was purchased by the Thomson-Houston Co. in 1888, Van Depoele went to the Lynn factory of the latter company. Many did not then consider the carbon brush as practicable, and it was some time before Mr. Van Depoele had an opportunity to demonstrate its possibilities. When the time did come its great value was so apparent that it was at once adopted for motor work and subsequently has been used exclusively with generators.

Since the general adoption of the present method of mounting the motors directly on the axles, double reduction motors have been used. The supposed necessity of high speed of revolution in the armature made this obligatory. In 1890 it was found practicable to make motors in which the armature revolved at a slower rate and a single gear sufficed for the now greatly reduced reduction. From 10 and 12 to 1 with the old motor we come to 4½ to 1 with the new motor. The gears are enclosed in boxes and run in oil so that the noise has been reduced to a minimum, the offensive noise of the gears being practically eliminated. We have also gearless motors with no reduction and no gears.

Generator construction has kept pace with the improvements elsewhere.

As large stations have been built, generators have increased in size, and electrical companies are now producing 500 h. p. dynamos as readily as the steam engine builders respond to similar demands.

We have learned what it costs to operate electric railways and the result is gratifying. In 1888 it was prophesied that while electric roads might make good showings so long as the apparatus was new and curiosity riding lasted, in a short time the machinery would begin to wear out and the roads would be swamped by the great repair bills. In reality we find the almost universal testimony is that the longer the road runs, the less is the cost of repairs. This is, of course, not due to the fact the apparatus improves in quality with age, but the explanation is to be found in the very simple fact that as small defects are eliminated and the employees become more experienced and the organization is perfected, the apparatus is better cared for and injuries are prevented.

A very conspicuous example of this is the West End Street Railway, which has been under my own immediate observation.

In the contract between the Thomson-Houston Electric Company and the Railway Company it was provided that we should keep the overhead line and electrical apparatus on the cars in repair at a given price per car mile. There were many reasons which influenced us to enter such a contract, but the chief reason was that this was the uncertain element in the operation of an electrical railway, and unless this uncertainty could be eliminated, the West End would not make any contract. The cost of these repairs has steadily decreased, and on the 1st of October the West End Company avail themselves of their option and relieve us of this part of our contract, knowing there is now no uncertainty and that they can do the work themselves for less money than they pay us.

Some months since President Whitney gave to the public the detailed figures showing the receipts and operating expenses of the West End Road. These are of very great interest to all, and I give them in full for the purpose of drawing some conclusions from them:—

THE ELECTRIC SYSTEM.

	April.	May.	June.	July.
Gross receipts	$134,321	$144,638	$153,988	$144,552
General expenses	8,193	7,796	7,465	6,955
Track and car expenses.	47,447	45,443	39,629	43,891
Motive power	30,194	30,924	26,359	26,398
Total operating expenses	85,834	84,163	73,459	77,249
Net earnings	48,487	60,475	80,529	67,303
Miles run	394,459	376,321	360,567	377,191
Ratio of mileage	26.68	25.58	25.15	25.19
Per cent. operating exp.	63.36	58.18	47.70	53.44
Earnings per mile run	34.05	38.43	42.71	38.32
Expenses per mile run:—				
Motive power	07.65	08.22	07.31	07.00
Car repairs	01.39	01.33	01.18	01.17
Damages	00.75	00.89	00.16	00.12
Conductors and drivers.	07.33	07.36	07.25	06.92
Other expenses	04.63	04.56	04.47	05.37
Total exp. per mile run.	21.75	22.36	20.37	20.48
Net earned per mile run.	12.30	16.07	22.34	17.84

HORSE CAR SYSTEM.

	April.	May.	June.	July.
Gross receipts	$344,396	$374,605	$395,555	$409,878
General expenses	22,514	22,682	22,217	20,657
Track and car expenses.	136,693	127,902	125,393	135,954
Motive power	117,740	118,972	116,210	116,271
Total operating expenses	276,947	269,556	263,825	272,888
Net earnings	67,449	105,049	131,729	136,990
Miles run	1083,887	1094,683	1073,718	1120,377
Ratio mileage	73.32	74.42	74.85	74.81
Per cent. operating exp.	80.62	71.95	66.70	66.58
Earnings per mile run	31.77	34.22	36.85	36.58
Expenses per mile run:—				
Motive power	10.86	10.86	10.83	10.38
Car repairs	00.93	00.60	00.61	00.61
Damages	00.78	00.37	00.15	00.06
Conductors and drivers.	08.24	08.24	08.25	08.23
Other expenses	04.70	04.55	04.24	05.07
Total exp. per mile run.	25.55	24.62	24.58	24.35
Net earned per mile run.	06.22	09.60	12.27	12.23

THE ENTIRE SYSTEM.

	April.	May.	June.	July.
Gross earnings	$478,717	$519,244	$549,543	$554,431
General expenses	30,707	30,478	29,683	27,613
Track and car expenses.	184,141	173,344	165,027	179,853
Motive power	147,933	149,896	142,570	142,670
Total operating expenses	362,781	353,720	337,284	350,137
Net earnings	115,935	165,524	212,250	204,294
Miles run	1478,346	1471,004	1433,785	1497,568
Ratio of mileage	100	100	100	100
Per cent. operating exp.	76.82	68.12	61.37	63.15
Earnings per mile run	32.39	35.29	38.33	37.02
Expenses per mile run:—				
Motive power	10.01	10.19	09.94	09.53
Car repairs	01.05	00.79	00.76	00.75
Damages	00.77	00.50	00.15	00.07
Conductors and drivers.	08.03	08.01	08.00	07.91
Other expenses	04.68	04.55	04.67	05.12
Total exp. per mile run.	24.54	24.04	23.52	23.38
Net earned per mile run.	07.85	11.25	14.81	13.64

Taking the June figures, it will be noticed that the net earnings per electric car mile exceed the net earnings per horse car mile by 10.07 cents, while the operating expenses of the horse car lines exceed those of the electric car lines by 4.20 cents per car mile. The difference is 5.86 cents per car mile, which is the gain to the Company due solely to the public satisfaction with the electric service. Mr. Arthur Jones, of the T. H. International Co., first produced this figure, which he calls the "satisfaction figure."

The net earnings per electric car mile exceeded the net earnings per horse car mile by the following amounts:

In April	6.08 cents per car mile.
In May	6.47 cents per car mile.
In June	10.07 cents per car mile.
Mean	7.54 cents per car mile.

The net earnings of the horse cars for the three months averaged 9.36 cents per car mile, hence the electric cars showed a gain of 80 per cent. in the net earnings per car mile over the horse cars.

For the three months, we have the following figures for the electric cars:

Total receipts	$432,947
Total expenses	243,456
Percentage of expenses to receipts	56 p. c.

In St. Paul and Minneapolis, with a combined population of 350,000, there is to-day not one single horse car. Minneapolis has 120 miles of electric railways, all equipped with the overhead system, and St. Paul has 75 miles of electric railways and 15 miles of cable. Most of the cable mileage is to be abandoned and supplanted by electricity. The last car horse disappeared from the streets of Minneapolis in June of this year. The July report of the Minneapolis system shows:

Gross earnings	$107,751
Gross expenses	52,585
Net earnings	54,985
Percentage of expenses to receipts	49 p. c.

Cleveland, Buffalo, Rochester, Toledo, Omaha, Cincinnati and many other large cities are now operating their street cars almost exclusively with electric motors, and the universal testimony is favorable to the increased facilities afforded the public and the increased profits to the stockholders.

Not the least important of the developments of the last three years has been the financial development. The fine showings as to earnings, the gradual decrease in operating expenses, where increases were expected, the oft-demonstrated ability to run electric cars in all kinds of weather, in ice, snow, sleet, hail or rain has greatly improved the standing of electrical securities. An electric road is no longer an experiment, it is a paying investment and there are not a few instances where the introduction of electricity has been the salvation of a horse road that otherwise would have soon been in the hands of a receiver. The rapidly increasing demand for electrical securities is an evidence of a healthy growth of public sentiment in this direction. To equip electrically means the expenditure of money which must come from an increase of the bond or stock issued. The ability of the public to rapidly absorb these new bonds or stocks must be the ultimate limit of the ability of the railway companies to move in this direction.

In August the West End Street Railway Company put out four millions of common stock for additional electrical equipment under a plan of subscription which provided for two deferred payments. When the subscription books were closed on the 5th of August, 33,000 shares had been paid in and only a paltry 245 shares had taken advantage of the option for deferred payments. I know of no more striking object lesson than this, except perhaps the rapid rise of the West End common stock from 63 to 77, which immediately followed.

Electric securities have heretofore been offered at tempting figures, but the day for this is passing. The public are realizing that a good street railway security is better than a western railroad bond or stock, and the electric roads are better than the horse roads. Electric railways will pay where no one would dream of building a horse road, and when the public taste is whetted for electrical securities, we shall see a marvellous increase in the number of roads and the equipment of existing roads that will mean transportation facilities for thousands who are now unprovided for, and many years' work for our electrical factories.

CENSUS REPORT.

After the discussion of the paper President Huntley announced that Allen R. Foote, appointed to take charge of the collections of statistics relating to the electrical industry, had just received a telegram stating that all investigations had been postponed, and all agents had been dropped.

Dr. A. F. Mason introduced a resolution requesting the Superintendent of Census, or, if he should not be empowered, the Secretary of the Interior, to provide for the completion of the work; the resolution also directed the executive committee of the association to secure the reintroduction of senate bill 4329, appropriating $50,000 for the special work under Mr. Foote's direction. The resolutions were adopted. It was also voted that a committee of five members be appointed to carry the resolution to Washington and present them to the Superintendent of Census, the Secretary of the Interior, and if necessary to the President.

REPORT ON SAFE WIRING.

The report of the Committee on Safe Wiring was taken up. The report was adopted as follows:

REPORT ON SAFE WIRING.

Your committee on Tabulating, Wiring and Insurance rules beg leave to report that they have had several meetings and conferences with representatives of the various interests involved, and as a result have formulated certain preliminary requirements which they think essential to safe wiring.

These must not be considered as rules to be absolutely followed, but rather in the nature of suggestions as to the line upon which each local association may form its own rules in detail. These requirements are as follows:

CLASS A.

Central Stations for Light or Power.

These rules also apply to Dynamo rooms in isolated plants, connected with or detached from buildings used for other purposes. Also to all varieties of apparatus, of both high and low potential.

GENERATORS OR MOTORS—Must be:

1. Located in a dry place.
2. Insulated on floors or base-frames which must be kept filled to prevent absorption of moisture, and also kept clean and dry.
3. Not exposed to flying or combusible material.
4. Each covered with a water-proof cover when not operating.

In no case must a generator be placed in a room where any hazardous process is carried on, such as the working room of a cotton, jute, flax, woolen or flour mill.

CARE AND ATTENDANCE.—A competent man must be kept on duty in the room where generators are operating.

Oily waste must be kept in metal cans and removed daily.

CONDUCTORS—From generators, switch-boards, rheostats or other instruments, and thence to outside lines, conductors must be:

1. In plain sight.
2. Wholly on non-combustible insulators, such as glass or porcelain.
3. Separated from contact with floors, partitions or walls through which they may pass, by non-combustible insulating tubes.
4. Kept rigidly so far apart that they cannot come in contact.
5. Covered with non-inflammable insulating material sufficient to prevent accidental contact.
6. Ample in carrying capacity to prevent heating. (See Capacity of Wires Table.)
7. Connected by splices or joints equal in carrying capacity to the conductors themselves, soldered if necessary to make them efficient and permanent.
8. When under floors or in distributing towers, placed in spaces ample for inspection and ventilation, and provided with special insulating covering.

SWITCH-BOARDS—Must be:

1. So placed as to make it impossible to communicate fire to surrounding combustible material; accessible from all sides when the connections are on the back; or may be placed against a brick or stone wall when the connections are entirely on the face.
2. Kept free from moisture.
3. Made of non-combustible material, or of hard wood, filled to prevent absorption of moisture.
4. Equipped with bars and wires in accordance with rules 1, 2, 4, 5, 6 and 7 for placing conductors.

RESISTANCE BOXES AND EQUALIZERS—Must be:

1. Equipped with metal or non-combustible frames.
2. Treated as sources of heat.
3. Placed on the switch at a distance of a foot from combustible material, or separated therefrom by asbestos or cement.

LIGHTNING ARRESTERS—Must be:

1. Attached to each side of every overhead circuit connected with the station.
2. In plain sight.
3. On the switch-board or in an equally accessible place, away from combustible material.
4. Connected with at least two earths by separate wires of large size.
5. So constructed as not to maintain an arc after the discharge has passed.

TESTING—All series and alternating circuits must be tested every two hours while in operation to discover any leakage to earth, abnormal in view of the potential and method of operation.

All multiple arc low potential systems (300 volts or less) must be provided with an indicating or detecting device, readily attachable, to afford easy means of testing where the station operates perpetually.

Data obtained from all tests must be preserved for examination by insurance inspectors.

CLASS B.

Arc (Series) Systems.

OVERHEAD CONDUCTORS—All outside overhead conductors (including services) must be:

1. Covered with some insulating material, not easily abraded.
2. Firmly secured to properly insulated and substantially built supports. All the wires having an insulation equal to that of the conductors with which they are connected.
3. So placed that moisture cannot form a cross-connection between them, not less than a foot apart and not in contact with any substance other than proper insulating supports.
4. At least seven feet above the highest point of flat roofs and at least one foot above the ridge of pitched roofs, over which they pass or to which they are attached.
5. Protected whenever necessary, in view of possible accidents to conductors or supports, from possibility of contact with other conducting wires or substances to which current may leak, by *dead insulated guard irons or wires.* Special precautions of this kind must be taken where sharp angles occur, or where any wires might possibly come in contact with electric light or power wires.
6. Provided with petticoat insulators of glass or porcelain. Porcelain knobs and rubber hooks are prohibited.
7. So spliced or joined as to be both mechanically and electrically secure without solder. They must then be soldered to insure preservation and covered with an insulation equal to that on the conductors.

The following formula for soldering fluid is approved:

Saturated Solution of Zinc	5 parts
Alcohol	4 parts
Glycerine	1 part

Conductors should not be run over or attached to buildings other than those in which light or power is being, or is to be used, but on separate poles or structures always easily inspected.

Service blocks must be covered over their entire surface with at least two coats of waterproof paint and so maintained.

Wires for high and low potential circuits *should not* occupy the same support.

Telegraph, telephone and similar wires must not be placed on the same arm with electric or power wires and *should not* be placed on the same structure or pole.

Interior Conductors.

ALL INTERIOR CONDUCTORS—Must be:

1. Where they enter buildings from outside terminal insulators to and through the walls, covered with extra moisture-proof insulation, and must have drip holes outside, preferably slanting upward toward the inside and bushed with moisture-proof and non-combustible insulating material.
2. Arranged to enter and leave the building through a double contact service switch, which will effectually close the main circuit and disconnect the interior wires when its current is turned "off." The switch must be so constructed that it shall be automatic in its action, not stopping between points when started, so as to prevent an arc between the points under all circumstances; it must indicate on inspection whether the current be "on" or "off," and be mounted on a non-combustible base in a position where it can be kept free from moisture, and easy of access to police or firemen.
3. Always in plain sight, never covered, except in special cases, where an armored tube may be necessary.
4. Covered in all cases with a moisture-proof non-combustible material that will adhere to the wire, not fray by friction, and bear a temperature of 150 degrees F. without softening.
5. In dry places, kept rigidly apart at least one foot, except when covered (in addition to insulation) by a moisture-proof substance enough to protect the insulating covering from injury. Conductors thus placed may be run not less than three inches apart, where non-conducting and non-inflammable tubing is used, which must be strong and be fastened with staples, under which are placed mechanically rigid insulating strips or saddles of greater width than the metal of the staple, by which possibility of injury to the tube may be prevented.
6. In damp places, attached to glass or porcelain insulators, and separated ten inches or more.
7. When passing through walls, floors, timbers or partitions, treated as in central stations under like conditions.

Lamps and Other Devices.

ARC LAMPS MUST BE IN EVERY CASE:

1. Carefully isolated from inflammable material.
2. Provided at all times with a glass globe surrounding the arc, securely fastened upon a closed base. No broken or cracked globes may be used.
3. Provided with a hand switch, also an automatic switch, that will shunt the current around the carbons should they fail to feed properly.
4. Provided with reliable stops to prevent carbons from falling out in case the clamps become loose.
5. Carefully insulated from the circuit, in all their exposed parts.
6. Where inflammable material is near or under the lamps, provided with a wire netting around the globe and a spark-arrester above, to prevent escape of sparks, melted copper or carbon.

Incandescent lamps in series circuits, having a maximum potential of 350 volts or over, must be governed by the same rules as are arc lights, and each series lamp provided with a hand switch and automatic cut-out switch; when lights are in multiple series, such switches and cut-outs must not control less than a single group of lights. Electro-magnetic devices for switches are not approved.

Under no circumstances, will incandescent lamps in series circuits be allowed to be attached to gas fixtures.

CLASS C.

INCANDESCENT (LOW PRESSURE) SYSTEMS (300 VOLTS OR LESS).

Overhead Conductors.

OUTSIDE OVERHEAD CONDUCTORS—Must be:

1. Erected in accordance with general rules for Arc (Series) Circuit Conductors.
2. Provided with suitable safety fuses at junctions of distributing mains with feeding conductors.
3. Separated not less than six inches, where they enter buildings as service conductors, and be provided with a double pole fusible cut-out, as near as possible to the point of entrance to the building, and outside the walls when practicable.

Underground Conductors.

UNDERGROUND CONDUCTORS—Must be:

1. Provided with suitable protecting devices at the ends of tube or conduit services inside the walls of buildings, as a guard against moisture and injury.
2. Terminated at a properly placed double polehouse cut-out.
3. Of specially insulated conductors after leaving the tube or conduit, and separated by at least ten inches, until the double pole cut-out is reached.

Inside Wiring.

Wire should be so placed that in the event of the failure or deterioration of their insulating covering the conductors will still remain insulated.

At the entrance of every building there shall be a double pole switch placed in the service conductors, whereby the current may be entirely cut off.

CONDUCTORS MUST NOT BE:

1. Of sizes smaller than No. 16 B. & S., No. 18 B. W. G., or No. 3 E. S. G.
2. Lead or paraffine covered.
3. Covered with soft rubber tube.
4. Laid in mouldings of any kind in damp places.
5. Laid in mouldings with open grooves against the wall or ceiling.
6. Laid in mouldings where less than half an inch of solid insulation is between parallel wire, and between wires and walls or ceilings.
7. Laid in plaster, cement or similar finish.
8. Concealed unless easily accessible, and preferable in approved conduits or wire-ways.

Mouldings, where admissible, must have at least two coatings of water-proof paint and be impregnated with a moisture repellent.

CLEATWORK is not desirable, and cleats must *not* be used unless

1. In a very dry place.
2. In a place perfectly open for inspection at any time.
3. They are of porcelain, or well-seasoned wood, filled, to prevent absorption of moisture.
4. They are so arranged that wires of opposite polarity, with a difference of potential of 150 volts or less, will be kept at least two and one-half inches apart, and that where a higher voltage is used, this distance be increased proportionately.
5. There is a backing provided, of wood at least half an inch thick, well seasoned and filled, to prevent absorption of moisture.

STAPLES must never be used to fasten conductors unless

1. Provided with an insulating sleeve or saddle rigidly attached to the metal of the staple and having such strength and surface as to prevent mechanical injury to the insulation of the conductor.
2. Under conditions in which cleatwork would be acceptable or where driven into a moulding specially adapted for open work.

Special Wiring.

Wherever conductors cross gas, water, or other metallic pipes, or any other conductors or conducting material (except arc light wires), they should be separated therefrom by some continuous non-conductor at least one inch. In crossing arc light wires the low tension conductors must be placed at a distance of at least six inches. In wet places an air space must be left between conductors and pipes in crossing, and the former must be run in such a way that they cannot come in contact with the pipe accidentally. Wires should be run *over* all pipes upon which condensed moisture is likely to gather, or by which leakage might cause trouble on a circuit.

In rooms where inflammable gases may exist, or where the atmosphere is damp, the incandescent lamp and socket should be enclosed in a vapor tight globe.

In breweries, stables, dye-houses, paper and pulp mills, or other buildings specially liable to moisture, all conductors, except where used for pendants, must be:

1. Separated at least six inches.
2. Provided with a durable, water-proof covering.
3. Carefully put up.
4. Supported by porcelain or glass insulators.

Moisture proof and non-inflammable tubing may be accepted in lieu of such construction.

No switches or fusible cut-outs will be allowed in such places.

INTERIOR CONDUITS MUST NOT BE:

1. Combustible.
2. Of such material or construction that the insulation of the conductor will ultimately be injured or destroyed by the elements of the composition.
3. So constructed or placed that difficulty will be experienced in removing or replacing the conductors.
4. Subject to mechanical injury by saws, chisels or nails.
5. Supplied with a twin conductor in a single tube where a current of more than 10 amperes is expected.
6. Depended upon for insulation. The conductors should be covered with moisture-proof material.

The object of a tube or conduit is to facilitate the insertion or extraction of the conductors, to protect them from mechanical injury, and as far as possible from moisture.

Twin tube conductors must not be separated from each other by rubber or similar material, nor by cotton or other readily carbonisable substance.

Conductors passing through walls or ceilings must be encased in a suitable tubing, which must extend at least one inch beyond the finished surface until the mortar or other similar material be entirely dry, when the projection may be reduced to half an inch.

DOUBLE POLE SAFETY CUT-OUTS must be:

1. Placed where the overhead or underground conductors enter a building and join the inside wires.
2. Placed at every point where a change is made in the size of the wire (unless the cut-out in the larger wire will protect the smaller). This includes all flexible conductors. All such junctions must be in plain sight.
3. Constructed with bases of non-combustible and moisture proof material.
4. So constructed and placed that an arc cannot be maintained between the terminals by the fusing of the metal.
5. So placed that on any combination fixture, no group of lamps requiring a current of six amperes or more, shall be ultimately dependent upon one cut-out.
6. Wherever used for more than six amperes, or (where the plug or equivalent device is not used) equipped with fusible strips or wires provided with contact surfaces or tips of harder metal soldered or otherwise having perfect electrical connection with the fusible part of the strip.

SAFETY FUSES must be so proportioned to the conductors they are intended to protect, that they will melt before the maximum safe carrying capacity of the wire is exceeded.

All fuses, where possible, must be stamped or otherwise marked with the number of amperes equal to the safe carrying capacity of the wire they protect.

All cut-out blocks when installed must be similarly marked.

The safe carrying capacity of a wire changes under different circumstances, being about forty per cent. less when the wire is closed in a tube or piece of moulding than when bare and exposed to the air, when the heat is rapidly radiated. It must be clearly understood that the size of the fuse depends upon the size of the smallest conductor it protects, and not upon the amount of current to be used on the circuit. Below is a table showing the safe carrying capacity of conductors of different sizes in Birmingham, Brown & Sharpe and Edison gauges, which must be followed in the placing of interior conductors.

BROWN & SHARPE.		BIRMINGHAM.		EDISON STANDARD.	
Gauge No.	Amp.	Gauge No.	Amp.	Gauge No.	Amp.
0000	175	0000	175	200	175
000	145	000	150	180	160
00	120	00	130	140	135
0	100	0	110	110	110
1	95	1	95	90	95
2	70	2	85	80	85
3	60	3	75	65	75
4	50	4	65	55	65
5	45	5	60	50	60
6	35	6	50	40	50
7	30	7	45	30	40
8	25	8	35	25	35
10	20	10	30	20	30
12	15	12	20	12	20
14	10	14	15	8	15
16	5	16	10	5	10
		18	5	3	5

SWITCHES—Must:

1. Be mounted on moisture proof and incombustible bases, such as slate or porcelain.
2. Be double pole when the circuits which they control are connected to fixtures attached to gas pipes, and when six amperes or more are to pass through them.
3. Have a firm and secure contact, must make and break readily, and not stick when motion has once been imparted by the handle.
4. Have carrying capacity sufficient to prevent heating above the surrounding atmosphere.
5. Be placed in dry accessible places, and be grouped as far as possible, being mounted, when practicable, upon slate or equally indestructible back boards.

MOTORS.—In wiring for motive power, the same precautions must be taken as with the current of the same volume and potential for lighting. The motor and resistance box must be protected by a double pole cut-out and controlled by a double pole switch.

ARC LIGHTS ON LOW POTENTIAL CIRCUITS—Must be:

1. Supplied by branch conductors not smaller than No. 12 B. & S. Gauge.
2. Connected with main conductors only through double pole cut-outs.
3. Only furnished with such resistances or regulators as are enclosed in non-combustible material, such resistances being treated as sources of heat.

4. Supplied with globes protected as in the case of arc lights on high potential circuits.

Fixture Work.

1. In all cases where conductors are concealed within, or attached to fixtures, the latter must be insulated from the gas pipe system of the building.
2. When wired outside, the conductors must be so secured as not to be cut or abraded by the pressure of the fastenings, or motion of the fixtures.
3. All conductors for fixture work must have a waterproof insulation that is durable and not easily abraded, and must not in any case be smaller than No. 16 B. & S., No. 18 B. W. G., or No. 3 E. S. G.
4. All burrs or fins must be removed before the conductors are drawn into a fixture
5. The tendency to condensation within the pipes must be guarded against by sealing the upper end of the fixture.
6. No combination fixture in which the conductors are concealed in a space less than one-fourth inch between the inside pipe and the outside casing will be approved.
7. Each fixture must be tested for possible "contacts" between conductors and fixture, and for "short circuits," before the fixture is connected to its supply conductors.
8. The ceiling blocks of fixtures should be made of insulating material.

Electric Gas Lighting.

Where electric gas lighting is to be used on the same fixture with the electric light:
1. No part of the gas piping or fixture shall be in electrical connection with the gas lighting circuit.
2. The wires used with the fixture must have a non-inflammable insulation, or where concealed between the pipe and shell of the fixture, the insulation must be such as is required for fixture wiring for the electric light.
3. The whole installation must test free from "grounds."
4. The two installations must test perfectly free of connection with each other.

Pendants and Sockets.

No portion of the lamp socket exposed to contact with outside objects must be allowed to come into electrical contact with either of the conductors.

CORD PENDANTS—Must be:
1. Made of conductors, each of which is composed of several strands insulated from the other conductor by a mechanical separator of carbonisable material, and both surrounded in damp places with a moisture-proof and a non-inflammable layer.
2. Protected by insulating bushings where the cord enters the socket.
3. So suspended that the entire weight of the socket and lamp will be borne by knots, above the point where the cord comes through the ceiling block or rosette, in order that the strain may be taken from the joints and binding screws. All sockets used for wire or cord pendants should have openings at least equal to one-quarter inch gas-pipe size.
4. Allowed to sustain nothing heavier than a four-light cluster, and in such a case special provision should be made by an extra heavy cord or wire, as a mechanical reinforcement.
5. Equipped with keyless sockets as far as practicable, controlled by wall switches. In no case may a lamp giving more than fifty (50) candle power be placed in a key-socket on a flexible pendant.

CLASS D.

ALTERNATING SYSTEMS.

Converters or Transformers.

CONVERTERS—Must not:
1. Be placed inside of any building except the Central Station, unless as hereinafter provided.
2. Be placed in any but metallic or non-combustible cases.
3. Be attached to the outside walls of buildings, unless separated therefrom by substantial insulating supports.
4. Be placed in any other than a dry and convenient location (which can be secured from opening into the interior of the building, such as a vault) when an underground service is used.
5. Be placed without safety fuses at the junction between main and service conductors and safety fuses in the secondary circuits where they will not be affected by the heat of the converter.

Primary Conductors.

In those cases where it may not be possible to exclude the transformers and primary wires entirely from the building, the following precautions must be strictly observed:
1. The transformer must be located at a point as near as possible to that at which the primary wires enter the building.
2. Between these points the conductors must be heavily insulated with a coating of moisture-proof material, and in addition, must be so covered and protected that mechanical injury to them or contact with them shall be practically impossible.
3. The primary conductors, if within a building, must be furnished with a double pole switch, and also with an automatic double pole cut-out where the wires enter the building, or where they leave the main line, on the pole or in the conduit. These switches should, if possible, be enclosed in secure and fireproof boxes outside the building.
4. The primary conductors, when inside a building, must be kept apart at least ten inches, and at the same distance from all other conducting bodies.

Secondary Conductors.

The conductors from the secondary coil of the transformer to the lamps or other translating devices must be installed according to the rules for "inside wiring" for "Low Potential Systems."

CLASS E.

ELECTRIC RAILWAYS.

Power Stations.

All rules pertaining to arc light wires and stations, shall apply (so far as practicable) to street railway power stations and their conductors.

Railway Systems with Ground Return.

Electric railway systems in which the motor cars are driven by a current from a single wire, with ground or floor return circuit, are prohibited *except* as hereinafter provided:
1. When there is no liability of other conductors coming in contact with the trolley wire.
2. When the location of the generator is such that the ground circuit will not create a fire hazard to the property.
3. When an approved automatic circuit breaker or other device that will immediately cut off the current in case the trolley wires become grounded, is introduced in each circuit as it leaves the power station. This device must be mounted on a fireproof base and be in full view of the attendant.

Trolley Wires.

TROLLEY WIRES—Must be:
1. No smaller than No. 0 B. & S., copper, or No. 4 B. & S., silicon bronze, and must readily stand the strain put upon them when in use.
2. Well insulated from their supports, and in case of the side or double pole construction, the supports shall also be insulated from the poles immediately outside the trolley wire.
3. Capable of being disconnected at the power house, or of being divided into sections, so that in case of fire on the railway route, the current may be shut off from the particular section and not interfere with the work of the firemen in extinguishing the flames. This rule also applies to feeders.
4. Safely protected against contact with all other conductors.

Car Wiring.

All wires in cars must be run out of reach of the passengers, and shall be insulated with a waterproof insulation.

Lighting and Railway Power Wires.

Lighting and power wires must not be permitted in the same circuit with trolley wires with a ground return, except in street railway cars, car houses, and power stations. The same dynamo may be used for both purposes, provided the connection from the dynamo for each circuit shall be a double pole switch so arranged that only one of the circuits can be in use at the same time.

CLASS F.

BATTERIES.

When current for light and power is taken from primary or secondary batteries, the same general regulations must be observed as apply to such wires fed from dynamo generators, developing the same difference of potential.

CLASS G.

MISCELLANEOUS.

1. The wiring in any building must test free from "grounds" before the current is turned on. This test may be made with a magnet that will ring through a resistance of 20,000 ohms, where currents of less than 250 volts are used.
2. No ground wires for lightning arresters may be attached to gas pipes within the building.
3. All conductors connecting with telephone, district messenger, burglar alarm, watch clock, electric time and other similar instruments must, if in any portion of their length they are liable to become crossed with circuits carrying currents for light or power, be provided near the point of entrance to the building with some protective device which will operate to shunt the instruments in case of a dangerous rise of potential, and will open the circuit and arrest an abnormal current flow. Any conductor normally forming an innocuous circuit may become a source of fire hazard if crossed with another conductor through which it may become charged with a relatively high pressure.

A. J. DECAMP, Chairman.
M. D. LAW.
STEVEN E. BARTON,
By C. F. Pollard, Att'y.
WM. BROPHY.
T. CARPENTER SMITH.

Certain questions have come before the Committee, which they considered of too great importance to be decided at this stage. Among these are the subjects of the grounding of the neutral wire in compensating or three wire systems,—the grounding, either permanently or by automatic cut-outs of the secondary wires in transformer systems, the adoption of a uniform alloy for fusible cut-outs, and the adoption of better methods for testing circuits.

From the nature of the electrical business and the rapid advance it is making, there must of necessity, questions continually arise which can only be decided by a later and larger experience, therefore the object of the Association would be best served by the appointment of a permanent committee to whom should be referred all such questions, which they shall consider and report upon at the next succeeding meeting of the Association.

Your Committee, therefore, offer the following:—

Resolved: That a committee of five be appointed by the President to be a permanent committee on safe methods of construction and operation—any vacancies that may occur on the committee from time to time to be filled by the President.

WM. MCDEVITT.
T. CARPENTER SMITH.
WM. BROPHY, per S.
M. D. LAW, per S.

C. J. Field read the following paper:

ELECTRIC RAILROAD CONSTRUCTION AND OPERATION

BY C. J. FIELD.

The advantages of the electric railway have passed beyond the age of experiment or question. They are proved by their development in the past four years, and any argument as to their advantage in the general development of street railway practice or suburban rapid transit is antedated. It took several years to convince old staid financiers and directors of the larger street railway properties that it was to their financial advantage to throw in the scrap heap several million dollars, more or less, in equipment and spend that amount in addition and still make it pay; but they have seen this advantage in the development and increase of traffic and returns to their company. These returns have been brought about principally by the development of rapid transit, in the introduction of electricity and the flexibility of the system in adapting itself to all and any conditions of commercial practice.

In looking over the past four years of practice in electric railway work, we have much to commend and considerable to condemn. The boldness of the achievements, the problems that have been solved, the rapidity of development and the perfection of the apparatus, seem almost beyond comprehension. That this apparatus, in less than four years, should reach the high state of perfection, economy and efficiency that it has, as compared to the long years of development of other mechanical appliances, is remarkable. The natural consequence of this large amount of work and development in this short time is that there has been much work done that had better been left undone. In the way of poor engineering, cheap work, and not a proper appreciation of the problem to be solved. These, in some poor instances, have retarded the development and progress of electric railway work in their vicinity, but street railway companies have now come to a proper appreciation of the necessity of good work well done and that the wisest and best method is to consider carefully what will bring the best return for the money invested—not necessarily on the blind basis of the highest cost being the cheapest, for money can be wasted in this way as well as others. We have examples now in several directions of large equipments being installed on a sound engineering basis and with careful consideration of the best interests of the electrical interests, street railway owners and public combined, and we can safely add that there is no problem in this line which cannot to-day be taken up with a full assurance of practical solution and successful development in electric railway traction.

The future outlook of electricity in the development of rapid transit, inter suburban, and even express service, is assured. We are coming now to the solving of the larger problems in this work and bringing the public to a proper appreciation of the resources and possible achievements in this line and its superiority over the old fogy systems of the past. We even see a considerable number of our friends from cable engineering lines of street railroad work coming over into the electrical fold, fully appreciating that the cable system has a very limited field for successful development and that electric traction is very broad gauge in the field of engineering work. Therefore, with this outlook, better construction work, better engineering, better mechanics, the solving of these larger problems are assured, and we see even to-day, in a number of cases, electric suburban traffic supplanting steam on a cheaper, better and more successful basis. The favorable report of the New York Rapid Transit Commissioners has done much to add to public confidence in this direction. Electric manufacturing companies are assisting the development of the work by making their apparatus more substantial, better in construction and more satisfactory in its mechanical design and operation. The reduction in the speed of the motors, the development of single reduction and even of direct connected motors, is doing much to add to the confidence in this line.

We hear asked sometimes, by laymen, the question: "What speed can electricity obtain in railway work?" The able consideration of this subject in several papers, and practical experiments as well, enables us to reply very briefly but confidently to this inquiry, that speed and power in electric railway traction are only limited by road-bed construction; in other words, any speed is obtainable within the range of possibility, with the maintenance of proper track. We do not intend, however, to generally review electric railway work, but more particularly to give some details of the practical problems in their construction and operation, and, therefore, we will leave the consideration of other parts of the subject to papers which will, no doubt, treat it more fully.

STEAM PLANT.

The consideration of the best development in the power generation of electric railway work has been one that has received considerable attention in past years from the best engineers in this line. We reach here a part of the problem which requires much more careful consideration than has been given steam power in electric lighting generally in the past. The work to be successfully done by the steam engine in the generation of electricity for the operation of railroads is the severest kind, and can be compared only to that of the engine operating rolling mill trains. It is owing to not fully appreciating this fact that we hear in some parts of the country of failures of steam plant on this kind of work. Electrical manufacturers are assisting the solution of this problem by the building of larger generators in units of 200 to 400 or 500 horse-power. What we want in the generating station for electricity is the smallest division of units consistent with the safe and economical operation of the station. Following the problem out on this line, we can build a successful station; and we would add to this that each unit should be entirely independent and separate from all other units, thereby increasing the reliability. This cannot be obtained in a safe and economical way by the use of our old friend, the countershaft. Undoubtedly, the countershaft has been of much use in electric lighting service, and particularly in arc lighting, but in railway work, with large generators, we can see no excuse at the present time for its use. Generators should be belted direct to the engines, whether Corliss or high speed, or else coupled direct to the engine shaft. With a Corliss engine

of 500 horse-power, operating at 80 or 90 turns, with a fly-wheel 18 to 20 feet in diameter we can belt with belt centers of, say, 40 feet, 2 inches, generators of several different commercial types; this gives us advantages which we have heretofore had only in high speed engines with direct connection. The engines should, in any event, as heretofore stated, be extra heavily built for the work to be done, with ample fly-wheel capacity. On engines of this size and speed a fly-wheel capacity of approximately 60,000 lbs. is about right. On engines operating about 150 turns, say 30,000 to 40,000 lbs.

While laying particular stress on the rapid and sudden changes of load, we do not know how to illustrate it more forcibly than in Figs. 1 and 2. Fig. 1 will show a practical case of changes in the indicator diagram within one minute, placed on the cylinder of an engine running on railway work, which shows a variation within that time of from full load to no load, and back again several times. Fig. 2 illustrates a load diagram from an ordinary case which has not been particularly selected for its maximum and severe conditions. These impress on the mind more forcibly than words can the requirements of this work. High speed engines in the development of railway work have received in some cases a set-back, owing to the engine manufacturers not appreciating fully the conditions and necessity of the work undertaken. So-called high speed or automatic engines can be as succesfully operated on this class of work as any other, if they are specially built for it. This means larger parts, bearings of more ample size and length and ample fly-wheel capacity. On a cross-compound engine of, say, 300 horse-power, there should be about six to eight tons in the fly-wheels, the bearings seven or eight inches in diameter, and 15 or 18 inches in length. (Such a type of engine is being furnished by the manufacturers of the Ball Engine.) In the case of engines built in this manner there can be no fault found with their operation. A type of engine which we believe is going to be largely used on this class of work, as well as lighting work, is one that will come in between the high speed engine and the Corliss, and which will combine many of the advantages of both. Such an engine has been sought for by many engineers and has been attempted by a number of builders. To-day, however, we can not find it on the commercial market. This engine, in units of 500 horse-power would run at a rotative speed of about 140 or 150 revolutions and with a piston speed of about 650 to 700.

The question which has troubled most engine men in regard to the high speed engine, with a single valve covering this kind of practice, has been a question of valves and clearances. Beyond any question, when it comes to this size, we have got to come to the Corliss practice of double valve; thereby reducing the clearances and bringing it down to the extent of the Corliss practice. The writer's company is having built, for the electrical railroad at Buffalo, two engines of this class, by the Lake Erie Engineering Works, which we believe will do much to develop this line of work, and, also, will be particularly adapted for coupling direct to the engine shaft.

The trouble in this line has been to get electric manufacturing companies to take up the building of large multipolar generators adapted for direct coupling at a speed of from 100 to 200 revolutions. This problem was developed on a smaller scale in this country, for marine plants, several years ago. We find that in Europe, where their work has been more special, that they have successfully developed this type of engine and generator, and beyond any question, it is going to be both for lighting work and for railway work, the type of unit for central station practice in the future. It means, where the vertical engine is used, the installation of the steam and electric plant in the space formerly used for engines alone. This means reduction in the cost of building, operation and maintenance.

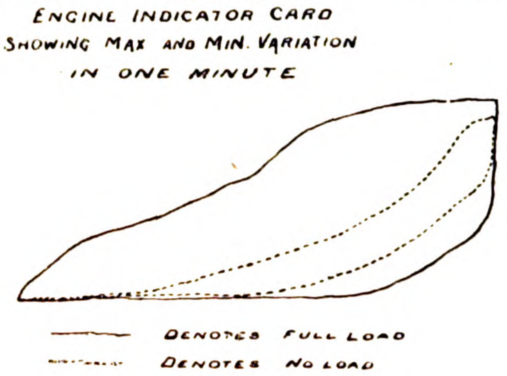


FIG. 1.

In concluding this part of our subject on steam generation, we trust that our experience in the past in lighting will show us the fallacy of poor steam engineering, and that we will build our stations for the future, and not have the problems before us that nine-tenths of the electric lighting stations have to-day, which mean, that in order to get down to commercial economy and competition they have got to rebuild their whole outfit. We will merely append to the consideration of the steam plant part of our problem a few interesting figures and data which the writer collected for presenting to street railway companies, in order to give them some useful information in this respect. We believe that they may be well introduced here. The figures given on the tables etc., are not ones that the manufacturer of an engine would tell you were those of the best economy for his engine or plant, but they are figures which will be appreciated by station owners and railway companies as those which are obtained in every day commercial tests.

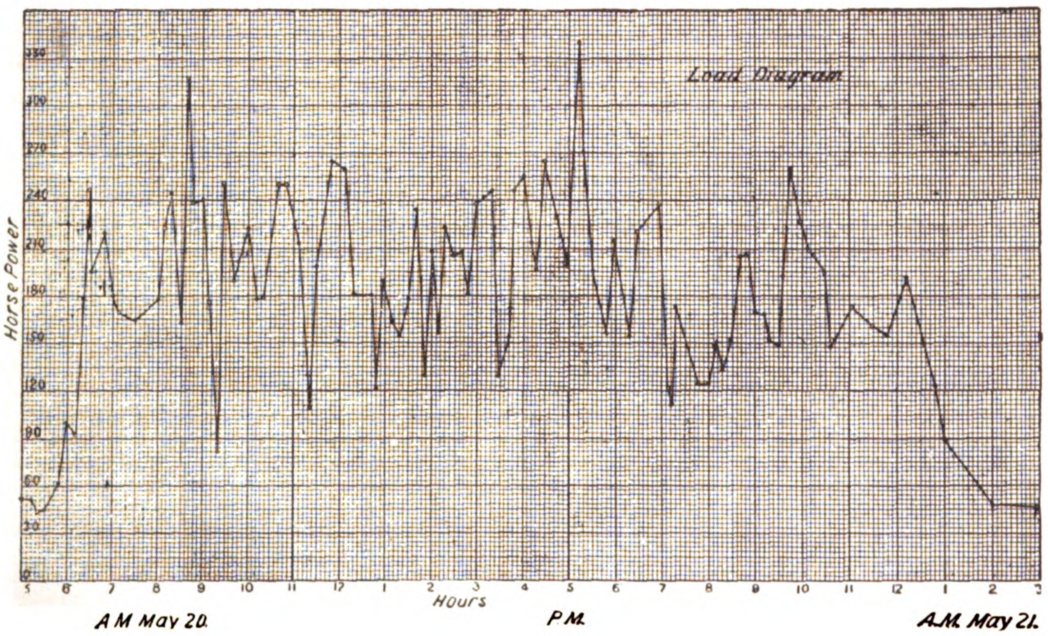


FIG. 2.

The relative commercial economy of engines and cost are as follows:

TYPE.	Lbs. of Coal per H. P. Hour.	Cost per H.P. sizes over 100 H. P.
High speed single	4 to 5	$11 to $13
High speed compound	3 to 3½	14 to 16
High speed compound condens'g	2¼ to 2½	
High speed compound triple	1¾ to 2	18 to 22
Corliss single	3½ to 4	16 to 18
Corliss compound condensing	1⅔ to 2	22 to 25
Corliss triple	1½ to 1⅔	27 to 30

This is based on an evaporation of 9 lbs. of water per lb. of coal.

There are four classes of boilers:

1. Horizontal return tubular, which is the most general in use, and costs $9 to $10 per horse-power.
2. Vertical tubular (Corliss or Manning) which is a vertical tubular boiler with water leg, giving an internal fire-box, economical in floor space, largely used throughout New England. Cost $10 to $12 per horse-power.
3. Sectional or water tube boiler, of which Babcock & Wilcox is the best known, especially adapted for higher pressures and safety. Cost $17 to $19 per horse-power.
4. Scotch type of Marine boiler—one that has not been used to any extent as yet in station work—but we believe it will be as an offset to the sectional type; and fulfilling the requirements for higher pressure and economy of space.

Capacity of engine requisite for different generators:

GENERATOR. WATTS	HORSE POWER.	HIGH SPEED ENGINE. Size.	Speed.	Wt. 2 Fly-wheels.
50,000	75	12 x 12	280	7,000 lbs.
80,000	125	15 x 16	225	9,000 lbs.
150,000	225	18½ x 18	200	15,000 lbs.
2,150,000	450	—	—	—

GENERATOR. WATTS	HORSE POWER.	CORLISS ENGINE. Size.	Speed.	Wt. 2 Fly-wheels.
50,000	75	—	—	—
80,000	125	—	—	—
150,000	225	20 x 36	90	25,000 lbs.
2,150,000	450	24 x 48	80	50,000 lbs.

Steam pressure, 100 lbs.

The cost of steam plant complete is about $50 to $60 per horsepower for high speed, and $65 to $75 per horsepower for Corliss.

ELECTRIC PLANT.

The question of the best electrical generating plant for railway work is one which is allied closely to that of steam plant, particularly in relation of the generators to that of the engines. In some respects, in treating of the steam plant, we have intimated what our idea was in connection with the generators. All large generators of from 200 to 500 horsepower connected as directly as possible, either by direct belting or shaft coupling, with the engines operating same. It is only by this development that the safest and best solution of electric railway station practice—in fact, station practice in general—can be reached. Manufacturers of railway generators have had an experience extending back many years, that experience in the development of direct current incandescent machinery, although not of quite the same voltage, has led the way up to the safe, economical and commercial development of railway generators, and we find the railway generator of today one of the most perfect and reliable factors in the electric railway system. The only problem remaining to be solved in this connection is to build them in larger types and have slower speed for direct shaft coupling. Generators on this work are subjected to the severest and most excessive strain, particularly where of small type, but the building of them in larger units is going to remove, to a great extent, the question of the overloading of the machine. Railway machines are often subjected to an overload of from 25 to 50 per cent. In general these are only momentary, and we find most of them able to stand up to the work to be done.

The question which puzzles many of the railway companies, as well as the electric companies, is what amount of generating capacity is necessary for the operation of a given number of cars. This question, of course, has got to be carefully considered in connection with each case, but there can in a general way be laid down an approximate basis for this work. Some railway companies, in order to show a higher economy than their competitors, are unwisely claiming the requirement of a smaller amount of power than others; but the wisest manufacturer is the one who urges his client to install a larger amount of power than is barely required for the successful operation of the road under any and all conditions. For if any one thing will lead the public to condemn the electric railway traction it is a lack of power, thereby causing the cars to move slowly, and in case of any accident, disabling part of the power. A fair basis on general conditions for 16 to 18 foot car bodies is 20 to 25 horsepower per car, which, with a properly designed and constructed plant, will give the desired power. The cost of generating this power for railway work for 16 and 18 foot cars is three to five cents per car mile for all expenses of the generating station. In some roads we find that cars of a larger size than these do not necessarily take a proportionately larger

amount of power. We find from practical experience that a car 32 or 33 feet long, double the size of the 16 foot car, takes under general conditions, about 50 per cent. more power, and we find by the same experience that a trail car adds about 50 per cent. to the amount of work to be done on the motor car for the same size. As to the minimum and maximum amount of power taken on an electric car, we find that a general average for a 16 foot car, under ordinary commercial condition, without excessive grades, is one horse power per car mile per hour; or, a car operating at an average 10 miles per hour means an average of 10 horsepower per car. This same car will give, however, on a load diagram, taking all its conditions, from maximum to minimum, a variation of from nothing to 50, 60 or even 80 horsepower. This gives us an idea of the severe strains and conditions to which an electric motor is subjected.

ELECTRIC CARS AND THEIR EQUIPMENT.

One of the questions on which we find more variety of opinion than any other is what is the best size, type and style of car for given case and conditions. The old standard 16 foot car body we find is now being widely departed from, and the problem is, How large a car can we get on a single truck with four wheels without excessive destructive effect on the roadbed? and, What is the longest car we can operate on street car service economically on an eight wheel base? We believe the limit is reached with a single truck in a 20 foot car body; we know that the truck manufacturers claim in some cases to operate a longer body, but we do not believe it wise. An 18 or 20 foot car running under close headway we believe to fulfill best the conditions of city traffic in the larger cities. Such a car, with a wheel base of seven feet, and in some cases seven feet six inches, where curves are not too sharp, will give satisfaction, and not be too severe on the roadbed where the same is properly constructed. As to the difference in effect on the road bed between the electric car and the horse car, it is briefly that the horse car is pulled by horses, from which it receives a balancing power and a steady pull, whereas an electric car is operating itself by a power moving the wheels against the track, having no steadying or balancing power from the pull of the horses and transmitting all its power and moving itself through the wheels. We find, therefore, that it subjects the track to a very severe pounding, necessitating a much better construction of roadbed, practically equalling that of a steam railroad.

Some companies have favored the use of a vestibule on street cars. We believe, though, that any vestibule is a failure and a misnomer. It accomplishes no good and causes much trouble; a shield over the dashboard for the motor man in winter weather would give all that would be required. What is wanted on a street car is that which will allow the freest ingress and egress from the car for the passengers, and anything that retards this—and a vestibule most certainly does—is a detriment and an obstacle to rapid transit. On some roads we have tried the introduction of even larger cars, say, 28-foot body, or 36 feet over all. Such a car, of course, has to be put on a double truck. These cars have found favor with some companies when first considering the problem; the difficulty with them is in getting the passengers in and out of the cars as quickly as possible, and making too many stops, due to the larger number of passengers carried. For inter-suburban heavy traffic, with few stops, we believe such a car would fulfill the requirements, but only in such a case.

Thus, having gone over the question of cars, we come to the consideration of the electric equipment for the same. To-day we find the double reduction motor discarded, as far as any new equipments are concerned. All the large electric manufacturing companies are placing single reduction motors on the market, and they are in successful commercial operation. One company is placing on the field a motor directly connected to the shaft and without any gearing—in other words, there is no reduction in speed, the speed of the armature being the same as that of the wheels—the same is accomplished by a very ingenious arrangement. We have heard asked in the past the question, Why was it necessary to place 30 horse-power to operate an electric car to do the work that two horses had done formerly? The answer is: The two horses did not do the work in a proper manner and give rapid transit. The life of a street car horse is very short, and we find under general conditions that 30 horse-power with two 15 horse-power motors has been found about right; in fact, we even find the companies tending towards a larger installation of power, particularly when using larger than a 16-foot car body, and we find to-day, being installed for rapid transit in inter-suburban work, 40 and 50 horse-power electric equipments per car, many of them operating at a speed of 30, and even 40, miles per hour. As the amount of power is directly proportionate to the speed, we can readily see the requirement for such an amount of power. The cost of a single car equipped, including the car body, truck and motors, is from $3,000 to $3,500, and the cost of the electric part of the power generating plant is from $35 to $45 per horse-power.

LINE CONSTRUCTION.

We find in the past about as great a development in overhead and line construction for electric work as in any other part of the subject. While formerly this was one of the greatest sources of unreliability in the operation of the plant, to-day, it has reached a very practical development. Formerly the trolley wires were too light, and feed wires were insufficient to furnish power, and the line was giving trouble, grounding and breaking continually. In the insulation of a single trolley system, with one side of the system grounded, we have the most severe requirements that it is possible to obtain in any electric insulation, in that any grounding on the other side of the system means trouble in the operation of the road. This has led to the introduction of double and even triple insulation into our line material to properly protect the trolley wire from grounding. Where streets are wide enough to spread the tracks to six feet and six feet six inches, within the near rails, we see introduced in many places center iron poles, which make a considerably stronger style of construction than cross-suspension. There are not many streets, however, where street cars are in operation that are wide enough, or where the city will allow the spreading of the tracks to this distance, and in closer proximity it is not safe to operate with center poles. On the work installed by the Field Engineering Co., in Buffalo, we find the most extensive system of overhead and underground construction in operation anywhere. Here all the feed wires, with a few exceptions, are placed in underground conduits, thus removing all cause for objection to the unsightliness of a large number of feed wires overhead. These underground feed wires are connected to the overhead wires from junction boxes up the poles.

The cost of overhead construction may be about summarized as follows:

Line construction per mile, complete, including track bonding, plain pole work, cross suspension or bracket with feed wire - - - - - - - - - - -	$2,000 to $2,500
With sawed and painted poles - - - -	2,500 to 3,000
Iron poles, cross suspension, concrete setting, double track, feed and guard wires - - - - - - - - - - -	6,500 to 7,500
Same with center poles - - - -	4,500 to 5,500

We also append a table which will give a general summary of the cost of electric equipment of street railway systems, omitting the track construction, which, of course, varies with the number of miles to be equipped.

COST OF ELECTRIC EQUIPMENTS FOR STREET RAILROADS.

No. of Cars.	Steam Plant. H. P.	Capacity of Generators. K. W.	Steam Plant. †	Station Electrical Equipment.
6	120	80	$ 7,000	$ 6,400
10	225	150	11,000	10,500
15	375	240	17,500	15,000
20	450	300	22,000	17,500
30	675	450	28,000	22,000
50	1,125	750	50,000	33,000
100	2,025	1,350	90,000	60,000

No. of Cars.	Car Equipments, Car Trucks and Motors.	Line Construction ½ mile of Double Track per car.	Total Equipment (omitting track).
6	$ 19,500	$ 7,500	$ 40,400
10	32,500	12,500	66,500
15	48,750	30,000	111,250
20	65,000	40,000	144,500
30	97,500	90,000	237,500
50	162,500	187,500	433,000
100	325,000	375,000	850,000

The above figures are approximate only and based on the best City R. R. practice.

† Add 25 per cent. to these figures for Corliss.

TRACK.

The track of street railway companies before the introduction of electricity was more behind the times than any other part of their equipment. The old flat rail is antiquated and antedated, and in a few years its use will be obsolete. The necessities of electric railway traction—in fact, of any traction—have impressed upon the street railway companies in their equipments the requirement of a good road-bed for the successful operation of a road, and we find this part of the problem receiving as much attention as any with companies who appreciate fully the work before them. The general construction to-day is girder rails of from 60 to 80 lbs. per yard, placed on chairs where block paving is in use, with ties 2½ to 3 feet between centers. We find in some cases even 90 and 100 lb. rails used, but we believe in more moderate weight for the rails and the ties placed closer on centers. We believe this has been the general experience in railway work. Such a style of construction costs from $9,000 to $10,000 per mile. In suburban roads, on streets where there is no paving, we find the T rail being used; the road-bed can be properly constructed on this basis with 45 to 50 lb. rail, for $6,000 to $6,500 per mile, the rail being spiked directly to the ties.

In order to make a summary of the data and figures, I will give them a practical example.

I propose to take, as the best means of illustrating practically, the purchase, equipment and operation of a street railway system with electricity, a city with a population of say 100,000—with a dilapidated street railway system, earning a gross income of $125,000, to purchase same for $500,000—property rights, franchises, etc., and equip it with 40 miles of single track and 65 electric cars.

COST OF EQUIPMENT.

Steam plant (1,500 horse-power capacity):

Five engines, 250 horse-power each, compound condensing, size 16 inches x 32 inches x 42 inches, with wheels weighing 30,000 lbs., - - - - - - - - -	$ 32,500	
Eight R. T. boilers, 72 inches x 16 feet, -	9,600	
Jet condensers, - - - - - - - -	3,000	
Two boiler feed pumps, - - - - -	900	
Steam and exhaust piping, - - - - -	12,000	
Five engine foundations, - - - - -	3,500	
Eight boiler settings, - - - - - -	3,200	
Five 30-inch belts, - - - - - -	2,000	
Erecting and starting, - - - - - -	3,500	
Freight and miscellaneous, - - - -	2,500	
		$ 72,700

Electrical plant:

Five generators, 200 kilowatts, 7,500, -	$ 37,500	
Switchboard installation, foundations, etc.	4,000	
		41,500

Building:

Power station, including stack, traveling crane, etc., - - - - - - - -	$ 25,000	
Car house and repair shop, including tools, etc., - - - - - - - - -	15,000	
		40,000

Track construction:

40 miles girder rail construction, ties 2½ feet between centers, 63 lb. rail, etc., $1.15 per foot - - - - - - - - - - - -	$244,800	
Relaying including paving, etc., at 60 cents per foot, - - - - - - - - -	126,720	
Trucking, hauling, etc., - - - - -	24,000	
Ties, including 10 per cent. of joint ties, 130,000 at 40 cents, - - - - - -	52,000	
Ties, including 10 per cent. of joint ties, 15,000 at 70 cents, - - - - - -	10,500	
		456,100

Line construction:

Ten miles iron poles, etc., - - - - -	$75,000	
Ten miles wooden poles, etc., - - - -	40,000	
		115,000

Car equipment:

65 electrical equipments at $2,000, - - -	$130,000	
65 car bodies, 18-foot body, with open ends,	65,000	
65 trucks at $250, - - - - - - -	16,250	
		211,250

Summary:

Steam plant, - - - - - -	$ 72,700		
Electrical plant, - - - - -	41,500		
Building, - - - - - - -	40,000		
Track, - - - - - - -	456,100		
Line construction, - - - - -	115,000		
Car equipment, - - - - -	211,250		
		$936,550	
Superintendent's and Engineer's work, - - - - - - -	$50,000		
General and miscellaneous, -	50,000		
		100,000	
		$1,035,550	
Original purchase, - - - - -		500,000	
Total cost re-equipped, - - - - - -			$1,535,550
Gross income, say, $350,000.			

Net income, say 35 per cent., equal to 8 per cent. on cost, on the basis of an investment of about one million and a half of dollars, and from a property which in many instances was hardly earning its fixed charges formerly.

We have here illustrated a practical example of what is being done every day in this country at the present time in the purchase and equipment of street railway systems. In fact, we find a large number of bankers and capitalists giving it their earnest attention as one of the best fields for investment at the present time.

CENTRAL STATION IN CONNECTION WITH ELECTRIC RAILWAY WORK.

We desire to call the attention of central station owners to the profit to be made from the furnishing of power in street railway operation, and also by the combining in smaller towns of the street railway companies and electric light companies. The trouble in most cases in central stations obtaining contracts for power, outside of small roads, has been to convince the railway companies that the electric light station can economically and reliably furnish this power, and we must say that in many cases their fears are well founded. Therefore, it behooves the central station companies to place their generating plants and station, not only for their own business, but for this added business, in such a shape as to remove this objection. There is no reason why electric light stations should not do a large and profitable business in this line as well as in stationary motor work, for the same factor is introduced here and the same reasons why they can safely and profitably furnish this power; if they have a station properly built, and large enough to add this power, that factor is established. If they have a proper station operating force, in many cases this force need not be added to at all. As to what basis this work can be profitably done on, we hesitate to state figures, except in specific cases, but will try to give a general idea of some of them. For many small roads power contracts have been taken at so much per day, assuming a basis of 100 to 125 miles operated. Such contracts have been from $3 to $5 per car. The regular basis, in accordance with which most street railway companies make their contracts and desire to base their cost of operation, is the unit of car mile operated; therefore, most contracts are on this basis. This comes down, therefore, to a basis of from three to five cents per car mile; the latter figure we consider excessive, and one which would be only made by any company for temporary necessities. We know of cases where the matter has been carefully considered and the plant properly installed for it, where contracts have been made for between $2\frac{1}{2}$ and $2\frac{3}{4}$ cents per car mile for 16-foot cars, on roads with grades not exceeding $1\frac{1}{2}$ to 2 per cent. In this case, and, in fact, in most cases where the closer figures prevail, the railway company furnishes the generators and the station owner furnishes the steam power and all expenses of both steam and electric power due to ordinary wear and tear. A profitable source of investment has been found in the more moderate sized towns of, say, up to 30,000 or 40,000 inhabitants, in the installation of combined electric railway and lighting stations; the companies either equipping new ones or purchasing old street railway systems and dilapidated lighting plants running on an unproductive basis, but which have a good franchise and field for business. Such companies have proved very profitable, as the combining of the operating expenses for railway and lighting station has done much to reduce expenses, and in many cases one manager or superintendent has proved sufficient for the entire system.

What we have tried to prepare here has been, not a paper which will be so attractive to merely read, but in which will be combined a certain amount of data information which will be of use in the further consideration of the problems herein outlined, and trusting that, if we have accomplished nothing else, we have led you to a profitable line of thought, it is respectfully submitted.

FRIDAY'S PROCEEDINGS.

The following paper, by J. I. Ayer, was read at the session Friday morning:

THE CARE AND MANAGEMENT OF AN ARC LIGHTING SYSTEM.

BY J. I. AYER.

As central station men, it seems to me that we should demand of each other as much knowledge of the practice and experience as is practicable to give. In fact, if this association is to be useful, our meetings should be largely "experience meetings," and the practical experience of those engaged in the development of the lighting and kindred industries, if given liberally at each meeting, would be followed closely by those interested in the production of electrical apparatus and supplies, and would do much to advance the business and improve appliances. Believing that we are here, as central station managers, for mutual improvement and for the free interchange of ideas and experience, I have presumed to present you with a limited, though doubtless dry, outline of the practice which obtains in the central station under the writer's charge.

The station, as designed, has a working capacity of 6,000 arc lights, and is now operating daily 3,500, and about 200 constant current motors; 2,000 of these lights are distributed over an area of sixty square miles, suspended between and from poles fifty and sixty-five feet in length, at a height of from thirty-five to fifty feet above the roadway, an average distance apart of about 900 feet, and used for street lighting. The motors and about 1,500 lamps are operated for the usual varied service of private consumers. Sixty-nine circuits supply the lamps and motors, containing about 1,200 miles of wire and supported on 12,000 poles.

For generating the current we have six 600 h.p. Corliss engines, which drive 300 feet of shafting, from which are driven sixty-five 60-light and twelve 80-light 2,000 c.p. arc dynamos. The arrangement of the dynamos is such that we have ample room for the care of eighty-five machines on a floor space of about 100x45 feet, and are able to operate a large number of dynamos with a very limited amount of help. Four boys and one young man of very limited experience care for all the machines during the night, in an entirely satisfactory manner; while a suitable man, with three assistants, gives the necessary care to the dynamos during the day.

Thirty-one trimmers, with horses and carts, travel about 500 miles a day to renew the carbons in the street lamps. The average number of lamps to each of these trimmers is sixty-eight. Sixteen trimmers care for the 1,500 commercial lamps. Five inspectors, or troublemen, with carts and horses, care for the lines night and day, answer fire alarms, locate faults and correct minor troubles on the lines. Two day and two night inspectors care for the commercial arc and 2,500 incandescent lamps. A stable of twenty horses, in addition to the forty horses owned by the trimmers and inspectors, is required. The maintenance of sixty vehicles justifies a blacksmith and wagon shop, which, with the stable, require the service of eight men. Two men care for the shafting, and three engineers and four oilers for the engine room. In the boiler house, where there are nineteen 300 h.p. boilers, there are two pump men, with two assistants, twelve stokers, one boiler cleaner, and six coal shovelers. These, together with an average force of thirty-five line and ground men, foreman, chief trimmer, chief inspector, superintendent of lines, store keeper, repair shop employes, carpenters, clerks, etc., constitute a force of about 170 men. A very large per cent. of these men are called upon to perform duties which are simple, yet, because of their extreme newness, are not thoroughly comprehended by them. To get the best results, each man requires clearly written rules, as few of them as possible, and their rigid enforcement. In all practice this is the wise way to put it; but it is absolutely necessary that it be so with a large force, where many of the men do their work independently and free from the constant supervision of a foreman.

In the room used as an office at the station by the inspectors and foremen are city maps, mounted on boards, where the locations of the lamps are indicated by tacks and the circuits by strings. For the central part of the city, where there are many circuits on the same line of poles, each circuit is shown on a separate map of that section. A number of printed slips, which represent a pole with cross arms, indicate the location of the wires on the poles on the different streets traversed by the different circuits. Any change of circuits is noted on a separate blank when the work is ordered, and when completed the maps are corrected to correspond. It takes but a few days for a man to become quite familiar with the circuits, by keeping them so conspicuously placed. In large stations this method of indicating circuits is almost indispensable, and will prove of great value if used in smaller ones.

For testing purposes we have a portable tachometer for indicating speeds, two Thomson indicators for the engines, a recording steam gauge, two standard ammeters and a voltmeter reading to 5,000 volts for the dynamo room; on each circuit a spring socket for attaching ammeters and a current indicator for indicating the direction the current is flowing through the circuit; near the lightning arresters on the upper floor, a switch board specially arranged for testing only; a Wheatstone bridge, magneto bells, etc. The engines are indicated once each day.

Evaporation boiler tests are made every month to see that the quality of coal is maintained at the standard. All the circuits are tested four times each day. All live circuits during the day are tested for grounds, and all others for apparent open circuits as well. In addition to this, all circuits are tested while alive by taking volt and ammeter readings simultaneously. The number of miles of wire and number of lamps being known, any material increase in the energy consumed gives evidence of a fault not always easily discovered by other methods. In testing for grounds on circuits not alive, a strong magneto bell is used. For all other testing a battery current of from 30 to 50 volts is used, and the circuit is required to pass at least one ampere to operate an ordinary call bell. When this bell is placed in series with a circuit which has more resistance than will pass this current at the pressure, the circuit is at once inspected and the fault located. In locating the trouble, one side of the bell circuit is connected to the line and the other to earth. The inspector or trouble man carries a similar bell with him, which he connects in series with the earth and line at various points, until the fault is located. The value of circuit testing with low voltage is keenly appreciated by those who have practiced it. When the circuits are alive, ammeter readings are recorded every two hours, and all readings are from the same instruments. These instruments are arranged so as to be read singly or in series, and one is used to check on the other. The value of first-class instruments in plants of any size cannot be overestimated, and should be in daily use in all stations, rather than the makeshifts generally supplied.

The stopping and starting of engines and boilers, pumps, dynamos, circuits, etc., are all recorded on reports made by those in charge of the different departments. Each inspector, trimmer, line foreman, storekeeper, and all heads of departments make daily reports of work done, and time and material used by them. Each trimmer is charged with a certain number of demerits for each fault on his route, such as defective or dirty lamps, broken or dirty globes, carbons used in excess of the required number, etc., and each month prizes are awarded to those having the best records.

The advantage of using vehicles for trimmers for street lighting work is being recognized. Provide a man with proper appliances and your service will improve. He cannot carry all that he should and walk long distances, nor will he take the same care when he is worn out with tramping that he otherwise would. We find it desirable for the trimmer to own and care for his own horse, while the company provides a suitable vehicle and harness, which he turns into the stable once a week for inspection, cleaning and repairs, when needed.

We select from our line men those whom we class as inspectors or trouble men, who are equipped with a light-running cart, with a suitable place for the storage of all tools necessary to use in an emergency. In addition to the special duty required of them during storms or at fires, these men correct all minor troubles reported to the office from various sources. During the first year's operations the average time lost, due to open circuits at night (that is, the average time lost from the time the circuit was opened until it was closed and the lights restored) was an hour and five minutes, notwithstanding that all circuits are more than ten miles in length. When these troubles occur, it is almost always during a storm, but the conveyances with which they are provided and their thorough knowledge of the circuits enable them to become very expert in locating and correcting troubles. During the past year nearly 15 per cent. of all the calls answered by our trouble men were to correct troubles on the lines of other companies. Because we have wires all over the city, the police, and the public generally, think that all the wires belong to us, and, when they discover any trouble with them, are very apt to report the same by telephone to our station. During the entire twenty-four hours there is always one man on duty, ready to answer just such calls and correct the troubles.

All arc lamps, before leaving the station, are placed in a test rack, where they are supplied with a current maintained absolutely constant. Voltmeter readings are noted soon after the lamps have been lighted, when the carbons are about half consumed, and also when they are burned quite short. During the early part of the burning the lamp is adjusted so that the readings, taken at three different points, give an average reading of 46 volts. In case of double lamps this work is carried out on both rods. This extreme care in regard to adjustment we regard as absolutely necessary. If a lamp is permitted to consume its carbons, any fault which would not be discovered with a brief test is quite likely to develop. To determine the length of arc by the eye, current and voltage is more likely to result in uniform lamps than where tested by the eye. With ten lamps, adjusted to burn at an average of 46 volts, with 95-10 amperes, the average number of watts per lamp was 436. Without changing the adjustment of the lamps, the current was

increased to 9 8-10 amperes, and there was an average consumption of 524 watts per lamp, an increase of 20 per cent. of energy; and by increasing the current to ten amperes, the average number of watts per lamp was 550, the average voltage 58, the increase above normal being 33 per cent. That means 33 per cent. more coal, 33 per cent. more work at your dynamo, 33 per cent. less capacity in your dynamo, and probably 33 per cent. less life in your armature. One is apt to think that the difference between 8 5-10 and 10 amperes, when supplied to the lamp, is only a difference of 5 or 10 per cent., which is not very serious. This would be true if the lamp was adjusted each time for the ampere current it was to be operated with. To those who have not made this experiment, perhaps, a portion of the mystery as to where the coal goes will be cleared up. By using the ammeter and voltmeter for adjusting the lamps, and then seeing that the circuits are provided with the same ampere current indicated by the same ammeter, one will be apt to bring about like conditions in all lamps; at least, they are more likely to be uniform than if independent ammeters are used on each circuit. By reference to this statement relative to the amount of energy consumed by change of current, it will be easy to see how expensive one or two low lamps would be on a circuit, where the operator, to correct the trouble, supplies them with current enough to make them bright. Of course it is understood that better service as well is obtained by operating the circuits with no more current than that for which the lamps are adjusted. In this connection, I believe it is proper to again call attention to the well-worn supject of connections. A great deal of time and trouble is spent in soldering joints, and when the lines are led to the lamp they are apt to be poked into the binding posts, held with set screws indifferently tightened, and between these binding posts and the lamp connections proper there are perhaps three or four, if not more, indifferent contacts, all of which look very well in the factory, but are very bad after a few months' service. Hanger-boards should be used which have the line wire soldered to connections which can not get loose. In our practice we accomplish this by using about 18 inches of flexible insulated cable, which is soldered to the hanger-board binding posts at the station (cut-out boxes are treated in the same manner) leaving the lineman nothing but an ordinary line joint to make, which can be easily done outside. Where lamps are suspended from the hanger-boards by the hooks which conduct the current, we always insist on some character of second connection being made to the lamp besides this. A simple way to do this is to take some small wire and tie the hook to the loop, in much the same manner as you would with a piece of twine. We have no screw connections anywhere in our circuits, and with a little ingenuity and care, they can be avoided always in arc lighting circuits. By the use of a special socket in each circuit for connecting an ammeter, we are able to take the readings with volt and ammeter, and get a correct indication of the actual consumption of energy on a circuit while in operation. With the data relative to the number of lamps in service and the number of miles and size of wire, we are able to discover any excessive consumption of energy and prevent the development of a series of little faults, which, in a short time, grow to be very serious ones if permitted to continue. Usually these readings are taken on each circuit three times a week, and during the time these observations are made, indicator cards are taken from the engines. From these two sources we get the actual consumption of electrical energy per circuit and per engine. We also get the indicated horse power. From a set of eleven observations taken from July 30, to August 28, at various hours during the night run, the station shows an efficiency, between indicated horse power and electrical horse power at dynamo terminals of 74.9 per cent., ranging from 70.3 per cent., the lowest, to 77.5 per cent., the highest efficiency shown. The circuit readings indicate an average consumption of energy per lamp of about 6-10 of an electrical horse power. The average indicated horse power is about 8-10 per lamp. A good condition of the circuits is maintained constantly, because any neglect in any department is quickly shown by the data obtained from our records. Some months ago, when press of business caused the measurement of circuits to be neglected for a few weeks, the writer discovered an increase of over ten per cent. in the consumption of fuel, when there should have been a slight decrease. An investigation showed that an accident to an ammeter had caused a false reading, which increased the cost of fuel alone about $16 a day. The difference in the appearance of the lamps was not such as to call forth special comments then by those interested, yet, when the fault was discovered, it was remembered that some seemed to have been burning high for a week or two. On suburban circuits on long loops, it is our practice to place cut-out boxes on the pole where the line branches. This saves a great deal of time in locating troubles; but, let me add that unless a thoroughly water-tight and substantial cut-out is used, it will prove more of an annoyance than an advantage. A log of each circuit and dynamo, as well as of engines and boilers, is a very satisfactory and desirable part of the records, and will frequently assist materially in locating troubles and saving expense.

Throughout the country it is almost the universal practice to wire for arc lights without cost to the customer. There is no valid reason for this custom, and for more than a year it has been our custom to charge for cost of labor, with the result of reducing expenses more than $600 per month. In every case where lamps are discontinued in the spring, we require a contract for fall and winter service, else the wires are removed when the lamp is taken down. We invariably cut down the line between the house and pole where the service is discontinued for the season, though it is to be renewed later. To induce annual contracts, a rebate of five per cent. is given at the expiration of the year, and is found to work to advantage.

There are very many details of construction, as well as of office work, which could be referred to, if it were not that this paper is now too long; but I will be glad to furnish a copy of "general instructions to employes," used in the government of this plant, which refer to and bring out some points of management which are not mentioned here, to those who care for them.

The following paper, prepared by E. P. Warner, was read by Mr. Nicholls:

Different Forms of Carbons Used In Arc Lighting.

BY E. P. WARNER.

In the period just preceding the introduction of the arc electric lighting commercially, experimentors and inventors had brought forward numerous plans, ideas, and theories regarding the size, form and manner of using carbons, and in view of the fact that no reasonably cheap method of generating the electric current then existed, a surprising amount of attention was given to the subject, and the developments of the art shown by many publications, form no small part of our history of arc lighting.

It is not my purpose to dwell at length upon the history of carbons generally, but rather to touch lightly on some of the more notable forms known, at the time of which I am speaking, and then to pass on to a consideration of the utility and practical results obtained with the different forms of carbons in use at the present time, paying special attention to the matter of form and size as affecting the results.

The form of a cylinder or pencil it is noteworthy was that used by Sir Humphrey Davy, in his earliest experiments, and he even devised special holders or claims to retain the carbon pencils in all alignment and facilitate their adjustment with a view of maintaining a constant and steady light.

Archereau subsequently adopted the pencil form of carbon and used it in his lamp now so justly considered as the first practical arc lamp, it does not appear, however, that he turned his attention particularly to the matter of form.

Wright and others stand on record as experimenters with carbon discs brought edge to edge and made to rotate as they were consumed, and the combination of a disc placed on edge above a vertical pencil of carbon was also tried at this early date.

Wallace and Farmer made use of broad flat plates of carbon, placed in a vertical plane, one above the other, the arc forming between the edges as they were drawn apart and shifting back and forth from one end of the plates to the other. Another inventor, at about this same date, placed flat plates of carbon side by side with the arc forming at the upper edges of the plates and an intervening insulation of some refractory material, the arc forming at the upper edges of the plates and gradually consuming them.

Jablochoff, in 1876, introduced his well known electric candle, a form of arc lamp in which cylindrical carbons are employed placed in a vertical position and held separated by a thin filling of refractory insulating material.

Now when we look back at the work of these early inventors and consider what special object they had in mind in making their experiments, it is at once apparent that it was continuity of action, and it stands on record that they met with fair success so far as the feature is concerned, some of the lamps being capable of twenty hours burning without attention.

In 1874 Mathias Day produced an arc lamp in which two cylindrical pencils were placed in the upper holders and two in the lower holders, the upper ones occupying a plane with the lower and directly over them; here the avowed object of the invention was to secure long-continued operation of the light without requiring attention, and it is certain that he accomplished it in a very creditable and ingenious manner.

Coming now to the time of the commercial birth of arc electric lighting, we find Jablochoff in the lead, closely followed by Brush and Weston, each making use of the cylindrical form of carbon pencil and turning their attention most assiduously to the feature of continuity of operation, the first move being an increase in length of the pencils. Carre, a French manufacturer, at this time, became prominent as a maker of carbons, and succeeded in producing pencils about 7-16 inch. diameter, and 32 inches in length, and it was thought by the use of lamps of suitable length these long carbon pencils could be advantageously used when long-continued burning was a necessity, but owing to the difficulties encountered in the manufacture and also trouble in maintaining proper alignment for the carbons a length of 22 inches was soon settled upon as most practicable and convenient.

As the business increased and the demands became better understood, the inventors again essayed to solve the problem of continuity of action, but, in many cases such attempts were but returns to old forms and methods, and did not result in any practical advance.

Various forms of double carbon lamps were introduced, and, for a time, these were thought to be the only practical and commercially successful way out of the difficulty, but more recent developments have shown a far simpler and better way, and one, furthermore, that cannot fail to impress the practical electrical engineer. I refer to the simple expedient of using a carbon pencil of 5/8 inch diameter 14 inches in length in an ordinary single carbon lamp. It is true that this is not new, and that carbon pencils of such size, or even greater, were tried long ago; nevertheless, the introduction of carbons of this size and form has a very great bearing on the commercial side of the situation; but before going into that matter I wish to say a few words regarding the lighting efficiency of 5/8 inch carbons.

Having noticed that the question had been raised as to whether these carbons would give as much light for a given expenditure of electrical energy, as would those of one inch diameter, I tried the following experiments:

Two single lamps were connected in series in an arc circuit, one being supplied with 5/8 inch carbons 14 inches in length, the other with 1/2 inch carbons 12 inches in length, around each lamp was branched a voltmeter indicating the voltage. The lamps were then adjusted until they had the same voltage, and as current was of necessity the same in each, it was a safe conclusion that equal amounts of energy were being supplied. Photometric comparison of the two lights was then made at the horizontal and at many different angles above and below, with the result that no perceptible difference could be found in the power of the lights, during the tests the current was maintained as constant as practicable and care was taken to base the comparison on an average deduced on a large number of readings.

Now while this matter of lighting efficiency is one that concerns the people operating electric plants; it does not interest them to the extent that other features upon which I have yet to touch, may, as I happen to know that the management of lighting stations look long and lovingly on any plan that seems to give good promise of reducing running expenses. To begin with, there is the difference in first cost between a single and a double carbon lamp, and the difference in the expense for repairs and attendance, these items varying of course with the different lighting systems. Still another important saving is in the cost of carbons, the cost for a given number of hours run, being fully thirty per cent greater with 1/2 inch than with 5/8 inch carbons. There is the further important saving in the breakage of globes which often is caused by the sudden shifting of the arc in the double carbon lamp. Twin carbons consisting of two cylindrical pencils placed parallel and in close juxtaposition to each other, and connected by a web throughout their entire length have of late been introduced and when in use the arc alternates between the different pencils comprising the upper and lower twin carbons. A test of these carbons made principally with a view of determining the life and lighting quality gave

unsatisfactory results in the following particulars. It was observed that the duration of burning for a given weight of material was not near equal to that which could be obtained with the same amount of material in a single cylindrical pencil. This I attribute to the more rapid disintegration of the turn carbon resulting from the very frequent heating and cooling of each member, indeed this is found to be true of two carbons where arranged as in the Day lamp, or so that the arc alternates frequently between the different sets, and there is quite a noticeable difference in consumption of carbon for a given duration of lighting as compared with an ordinary single carbon of the same diameter burning without interruption.

Another undesirable feature of twin carbons is the shadow cast by the non-burning members, which, while it may not be disagreeably noticeable when the lamp is provided with an open globe, most certainly operates to reduce the total output of light.

It may be argued that the main item of expense in the manufacture of carbons does not lie in the material, and the fact that 5/8 inch carbons cost so little more than 1/2 inch would bear out such a position, and I have merely mentioned the fact of the rapid disintegration and burning away of the turn carbons by way of explanation.

The association then went into executive session. The secretary presented his report, which showed that the membership to-day included 78 active members, and 142 associate members.

Resolutions were adopted expressive of the appreciation of the association for the cordial welcome it had received in Montreal.

Frederick Nicholls, M. D. Law, and A. M. Young were elected members of the Executive Committee.

Dr. Mason gave notice that he would offer an amendment to the Constitution, changing the name of the association from National to International.

Buffalo was selected as the next place of meeting of the association.

The association adjourned without day.

THE BANQUET.

The magnificent hospitality of the Canadians showed no abatement on Thursday, and in the afternoon the steamer "Filgate," which had been made available through the kindness of the Harbor Commissioners, was filled with visitors, who took the trip to the St. Lawrence by the way of the canals, and enjoyed the excitement of shooting the Lachine Rapids. In the evening was held the banquet at the Windsor, given by the citizens of Montreal to the members of the National Electric Light Association. After the dinner, and before commencing the toast list, Sir Donald Smith, who presided, called on T. C. Martin. The latter expressed the great appreciation of the association for the unprecedented reception that had been accorded to it by the city of Montreal. As a slight recognition he begged to be allowed to present to Prof. Bovey, chairman of the reception committee, to whose indefatigable exertions so much of the success of the Montreal gathering was due, a handsomely mounted phonograph. Prof. Bovey, to whom the presentation was quite unexpected, replied in a happy speech. The Governor-General Lord Stanley of Preston, gave a warm welcome to the visitors, and assured them that they would always be gladly received by the Canadians whenever they crossed the border. President Huntley, in an excellent speech, gave a sketch of the present position of the electrical industry, and showed what a grand field for electric development Canada offered. Mr. Huntley closed his speech by extending an invitation to Canadians to attend the Chicago meeting in 1893. Various toasts followed and the proceedings closed at a late hour.

DRIVE THROUGH THE CITY.

Wednesday afternoon was occupied by the visitors in driving around the city. The cavalcade started at 3 o'clock and after passing through the principal streets ascended Mount Royal, from the top of which they enjoyed the magnificent view of the city and the surrounding country. On their return at 5 o'clock they attended a garden party at the residence of Mr. Molson. A large number of the leading people in the city were present. In the evening a dance was given at the Windsor Hotel.

EXHIBITORS AT THE ELECTRICAL EXPOSITION AT MONTREAL.

Thompson & Robertson, of New York, exhibited their famous Fibrous dry batteries and the disque Leclanché porous cup. The exhibit was in charge of Louis Walsh, general sales agent.

Circulars descriptive of the improved Fishkill Corliss engine, manufactured by the Fishkill Landing Machine Co. were distributed in the exhibition hall.

Visitors had an opportunity to learn of the merits of the patent drill press built by Gould & Eberhardt, Newark, N. J., by perusing that firm's handsomely illustrated catalogue.

H. L. Lufkin represented the C. & C. Electric Motor Co. A beautifully illustrated catalogue in board covers descriptive of C. & C. motors and dynamos attracted notice in the exhibition hall.

F. Day Voorhees, general sales agent, represented the Norwich Insulated Wire Co.

The handsome display of electric and combination fixtures by Robt. Mitchell & Co., of Montreal, excited the admiration of visitors from the States.

The Wade dynamo register excited a good deal of interest among central station men. It watches the dynamo tender and automatically records the working of every circuit.

The Consolidated Electric Mfg. Co., of Boston, was represented by C. E. Bibber. The C. E. M. specialties—switches, sockets, cut outs, etc.—rank in the first class.

The Ferracute Machine Co. Bridgeton, N. J., were represented by an exhibit. The company's presses, dies and sheet metal goods for various purposes are favorably known.

J. Fitzgerald, of Montreal, exhibited combination fixtures of artistic design and finish.

The Fibrone Co., of New York, made an elaborate display of articles manufactured from "fibrone" and plasticon—excellent insulating materials adapted to a great variety of uses.

The display of the Eureka Tempered Copper Co., of North East, Pa., illustrated the varied uses of copper in the construction of electrical machinery. The company was represented by J. R. Phillips, of North East, and N. S. Possons, of Cleveland.

The Standard Paint Company, of New York, distributed its new brand, "P. & B." Invincible, an entirely new departure. Its fine exhibit was in charge of Frank S. De Roode and R. L. Shainwald, president.

The exhibit of the Dominion Wire Manufacturing Company, Limited, was in charge of R. B. Coulson and A. Hanra. A fine line of copper, brass, steel and iron wire was displayed.

The Ries Electric Specialty Company, of Baltimore, exhibited a new socket for incandescent lamps by means of which the candle power is regulated. E. E. Ries, president, and L. S. Greensfelder represented the company.

The New York Belting & Packing Co. distributed literature explaining the merits of the vulcanized rubber fabrics which have come to be so favorably known.

The advantages of the D. Frisbie Company's electric hoist were set forth in an illustrated circular.

The Weston Electrical Instrument Co., Newark, N. J., made a complete exhibit of instruments for electrical measurement.

The Le Boiteaux Electric Motor & Fan Co., of Cincinnati, exhibited oscillating and revolving fans that are about right. They distribute the breeze in all directions.

T. W. Ness, of Montreal, made a comprehensive exhibit of electrical supplies and specialties.

The Economic Lamp Company, of Boston, displayed a line of its incandescent lamps.

The exhibit of the Bernstein Electric Company showed the merits of its incandescent lamp for arc and railway circuits. H. B. Cram, treasurer of the company, was in attendance.

The Russell Electric Company, of Boston, exhibited its arc lamp in an attractive manner. H. E. Chapman and H. Dewar of the company were present.

The Bryant Electric Company, of Bridgeport, displayed its line of switches, sockets, etc.

The Canadian Electrical Construction Manufacturing & Supply Company had a fine exhibit which attracted much attention.

Perkins' Electric Switch Manufacturing Company, of Hartford, displayed a full line of the various devices and novelties of its manufacture. F. W. Davis, secretary of the company, was present.

The Delaware Hard Fibre Co., of Wilmington, exhibited its excellent insulating material in various forms.

L. E. Wilcox & Co., of Meriden, Conn., exhibited the speed wire stretcher.

William P. Mullin, vice-president of the Shultz Belting Company, exhibited samples of the leather link belts that have become so justly popular.

The carbon disc lamps manufactured by the Russell Electric Company, of Boston, exhibited in the hall, sustained their reputation for economy and efficiency.

Walter Wonham, formerly of the Hill Clutch Works, Cleveland, is now a resident of Montreal and a member of the firm of Henry Chapman & Co., dealers in wire.

The Gould Packing Company, of East Cambridge, Mass., exhibited samples of steam and motor packing goods that have found particular favor among engineers in charge of lighting plants.

The Brooks Carbon Works, of Peterboro, Ont., was represented by J. W. Taylor, who found many old friends among visitors from the states.

The Bryant Electric Company, of Bridgeport, Conn., displayed a fine line of specialties strikingly arranged.

Robin & Sadler, of Montreal, exhibited a line of leather belting supplies.

The Cord Electric Motor and Dynamo Company's handsome catalogue appealed to the artistic sense of all visitors.

C. A. Schieren & Co., of New York, exhibited their patent perforated electric leather belting. The opinion prevails that the Schieren belt is just right for service in lighting and railway work.

E. G. Willyoung, representing Jas. W. Queen & Co., Philadelphia, exhibited important improvements in measuring and testing instruments.

The Falls Rivet and Machine Company, of Cuyahoga Falls, Ohio, was represented by president E. L. Babcock, vice-president J. A. Long and F. W. Wier general Western manager.

The Johns-Pratt Company, of Hartford, exhibited samples of vulcabeston.

The exhibit of the Heisler Electric Light Company, of Philadelphia, was in charge of Oscar Heermann, electrician.

The exhibit of the Simplex Electrical Company, was tastefully arranged, displaying Simplex brand of insulated wire in immense coils. Dr. A. F. Mason, of the company, was in attendance.

Among the catalogues exhibited in the exhibition hall none were handsomer than those of the Abendroth & Root Mnfg. Company, New York. The superiority of the Root sectional boiler and spiral rivited pipe is generally recognized by steam users.

The Hazletine protection for doubling the life of carbons of arc lamps was exhibited by the Hazletine Electric Company, of St. Louis. C. W. Hazletine, president, was present.

People became satisfied that the Nubian Iron Enamel Company has produced a first class protector for exposed metal work.

The interests of the Smith & Vaile Company were ably looked after by J. M. Duncan, of New York.

A. D. Newton and M. E. Baird looked after the interests of the Eddy Electric Manufacturing Company, of Windsor, Conn. An Eddy motor occupied a prominent place in the exhibit of the Toronto Construction and Electrical Supply Company.

The electrical clocks exhibited by the Standard Electric Time Company, of New Haven, Conn., excited much favorable comment.

The Fort Wayne Electric Company, of Fort Wayne, represented by W. J. Morrison, sole agent for Canada, made an elaborate exhibit.

The Standard Underground Cable Company, of Pittsburgh, was represented by G. L. Wiley, and an excellent exhibit.

The Eugene F. Phillips Electrical Works' exhibit, in charge of W. A. Hathaway, was the attraction in a central position of the exhitition hall. The striking electrical display was much commented upon. Mr. Phillips and son were in attendance from Providence.

Visitors had ample opportunity to learn of the special points of merit in the Hart switches, manufactured by Hart & Hegeman, Hartford, Ct.

The Globe Electric Cordage Works, Philadelphia, exhibited a line of flexible incandescent cords. The company's goods are superior—no wonder they sell well.

The very novel exhibit of the Germania Electric Company was in charge of H. Bottomley, electrical engineer. The treasurer of the company, O. K. Stuart, was also in attendance.

The exhibit of the International Okonite Company cut a prominent figure in the exhibition hall. Capt. W. L. Candee kept okonite in the foreground throughout the convention.

A. H. Pattison, general manager, looked after the interests of the Phœnix Glass Company, of Pittsburg and New York. The company's exhibit included many new and beautiful designs in incandescent globes and shades, arranged to produce striking effects.

The exhibit of a line of samples of the manufactures of the Western Electric Company showed the possibilities of the salesman's outfit. "A traveling supply house, perfect in every detail," could well be applied to this exhibit. C. D. Crandall and S. A. Chase were in attendance.

The Electric Construction and Supply Company, of New York, exhibited its new arc lamp for alternating currents and the Ward arc lamp. R. B. Corey and J. C. Knight were in attendance.

The exhibit of E. S. Greeley & Co. was a prominent feature. Its complete line of electrical measurement instruments made a fine display. T. J. Smith, manager of the electrical department, and C. P. Frey and Frank Grant, electricians of the company, were present.

Dr. S. S. Wheeler, of the Crocker-Wheeler Motor Co., was one of the busy men during the convention. The company's exhibit included a line of motors and fans that was much admired.

The Jewell Belting Company, of Hartford, exibited a 30-inch double belt just manufactured for the Manufacturers' Electric Light Company, of Philadelphia, a 12-inch belt for railway dynamo. C. L. Tolles was in attendance.

Wm. Sclater & Co., of Montreal, displayed a line of asbestos coverings. The exhibit might have been mistaken for a Canadian winter scene after a heavy snow. The Crocker-Wheeler fan motors near by heightened this impression.

The New York Insulated Wire Company, of New York and Chicago, exhibited its specially new system of "Vulca" electrical wire ducts for interior wiring. These ducts are fire and acid proof and susceptible of a fine finish for decorative purposes. "Grimshaw White Core" wire and other specialties added to the display. J. W. Godfrey, A. Noll and Geo. H. Meeker, of the company, were present.

D. B. Dean and W. B. R. Wilcox occupied a spacious parlor in the Windsor and exhibited to many callers the railway supplies of the Electric Merchandise Company of Chicago, and the Burton Electric Heater. Much interest was manifested in the Burton heater—it has thoroughly established its claims.

The Ball Electric Light Co., of Toronto, made a fine exhibit, including arc and incandescent machines.

The popular Acme link belting occupied a prominent place in the exhibit of the Page Belting Co., of Concord, N. H.

The exhibit of the Thomson-Houston International Electric Company gave the visitor an opportunity to inspect the many fields of electrical work entered into by this company. An immense electric hoist handling a heavy load was a noticeable feature. Great and small motors for all kinds of work, including the latest type of street railway motors, were exhibited. Large arc light machines and a 650 light incandescent alternating dynamo were kept in constant use during the exposition. G. W. Davenport, C. Belknap, J. Kirkland and John B. Waterman were in attendance.

The Toronto Construction and Electrical Supply Co. had an extended exhibit. This company is the sole agent for Canada for the Grimshaw White Core Wire, Ward Arc Lamps, Crocker-Wheeler Motors, Eddy Motors, Jas. W. Queen & Co., Partrick & Carter Co., Standard Paint Company and the Standard Thermometer Company. F. Nicholls, second vice-president, G. C. Stannard and A. J. Christie represented the company.

The booth of the Electric Engineering & Supply Co., of Syracuse, was one of the most attractive in the Exhibition hall. The brilliant array of Packard lamps, artistically arranged and surmounted by revolving groups of colored lights, was generally admired. In the same booth were exhibited Queen & Co.'s electrical measuring instruments and Pass & Seymour's porcelain specialties, all of which are handled by the Electric Engineering & Supply Co. The company has also the Eastern and Canadian agency for the Jenney Electric Motor Co., which was given a prominent place in the exhibit. New catalogues were distibuted.

The Interior Conduit & Insulation Company, of New York, was represented by E. W. Little, general manager. The exhibit of the company excited general interest and commended the system as safe, economical and practical. The company is doing an enormous business. A telegram from New York received during the Convention announced that the company had in one day received orders for tubing aggregating 100,700 feet. Mr. Little was naturally elated.

The Edison General Electric Company's Exhibit occupied about one-half the space of the main floor. This display was arranged with much skill, and was so complete as to give one an idea of the extent of Edison's inventions. Immense coils of weather-proof wire, magnet wire, silk-covered wire, dynamos from 1/4 h. p. to 150 h. p. arranged in graded sizes, Edison-Lalande batteries, every conceivable size and shape of incandescent lamps, street railway motors with truck, lead-encaed telephone cables, electroliers and fixtures of rare beauty, the new arc light dynamo, the diamond drill, motor fans and blowers, model of three wire central station system complete with switch board, braiding machines and other apparatus were displayed. The current for the large 150 h. p. motor was transmitted 4,000

feet from an Edison generator in the McGill university. Samuel Insull, S. Dana Green, John Muir, L. Stieringer and M. J. Sullivan were in attendance.

Considerable interest was centered in the exhibit of H. Ward Leonard & Co. The new departure of Mr. Leonard of operating any shunt motor by an entirely new system, using no rheostat or other power consuming device, created much comment. An Edison motor wound for 1,600 revolutions was made to do its full work at 50 revolutions. A hoist connected with the motor was made to lift a weight of 150 lbs from an almost imperceptible start. The perfect control of the speed of the armature, without varying the efficiency of the pull, was a decided novelty. The exhibit was under the personal supervision of Mr. Leonard and his assistant, Mr. A. S. Vance.

McGill University exhibited electrical measuring instruments and other devices from its extensive laboratory. The current for a large part of the exposition was transmitted from the electric plant of the University.

The novelties exhibited by the A. B. C. Company, of New York, did not fail to receive much notice. P. H. Alexander, president of the company, was in attendance.

Messrs. Hagar and Starr, of the Royal Electric Company, of Montreal, will long be remembered for their courtesy during the convention.

MOVABLE SIDEWALKS AT THE WORLD'S FAIR GROUNDS.

October 7th, next, the World's Fair Grounds at Chicago, will be opened to visitors for the inspection of the progressing work, and for their accommodation there is being constructed an electric railway of a most ingenious and novel character, having a capacity to carry 30,000 passengers per hour, with the greatest comfort, convenience and safety. The railway department of the Chicago office of the Thomson-Houston Electric Company has closed a contract with the Columbian Movable Sidewalk Company, of Chicago, for the electrical and steam equipment of the movable sidewalk which is now being installed. The mechanical and electrical plans and details have been carefully worked out by G. K. Wheeler, of the company, and under his supervision the entire plant will be installed. The railway will differ from ordinary railwasy in that the passengers are transported on a movable sidewalk.

This sidewalk is located on the improved and unimproved portions of Jackson Park, and is to be constructed on an elevated structure twenty-five feet high and 900 feet long, in the form of an ellipse. It will consist of seventy-five cars, each 12 feet long, connected together, making one solid train. There is to be constructed two parallel sidewalks, one running at the rate of two miles an hour, the other at four. Both walks moving in the same direction. The passengers can step from the ordinary walk to the one which moves at the rate of two miles an hour, and if it is desired to move at a greater speed, they can step from this walk to the one running at four miles per hour. The passengers can safely walk upon either of the movable sidewalks while in motion if desired.

The structure will be illuminated at night by a number of Thomson-Houston incandescent lights, and as the grounds are to be illuminated with arc lights, a satisfactory view can be obtained during the evening as well as during the day.

Three of the 75 cars are to be equipped with two 15 h. p. Thomson-Houston railway motors each, mounted upon trucks with wheels 18 inches in diameter. The car platform is perfectly level with the stationary walk, allowing the trolley wire to be placed beneath the surface of the platform. The current is taken from the trolley wire by small trolleys attached beneath the car floors.

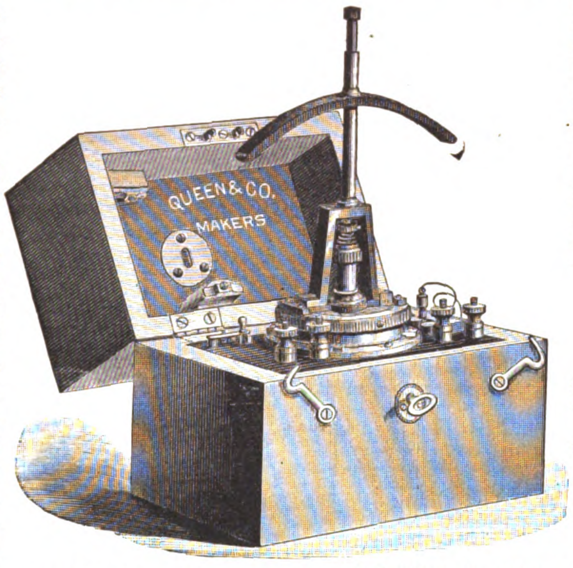
The entire train will be controlled and operated by one man. There will be constructed at a central point, at one side of the track, a controlling station, which will contain a main switch, reversing switch, automatic circuit breaker, lightning arrester, ampere meter and rheostats, all arranged so that they can be operated by the attendant from that point, who will have the train under perfect control. As an additional safeguard, pushbuttons will be arranged at twelve equally distant points along the line of track, which will be connected with an electric bell and the circuit breaker in the controlling station. In case of accident to the train, an attendant can, by pressing the button, automatically open the circuit at the station and stop the train instantly without the assistance of the operator.

The power for the operation of the sidewalk will be furnished by a Thomson-Houston 110 h. p. multipolar compound wound railway generator, located in a power house adjacent to the track.

QUEEN'S IMPROVED PORTABLE TESTING SET.

Something over a year and a half ago, Messrs. Queen & Co., Philadelphia, brought out their series of portable testing and resistance sets, which have been used very largely for all classes of resistance work throughout the country. It has been suggested that an improvement might be made under certain conditions in the galvanometer forming a part of these sets. As heretofore made this galvanometer has been of the astatic type, fibre-suspended, and arranged to automatically take the weight of the needle from the fibre when the lid of the case was closed. A controlling magnet enabled the needle to be made still more astatic. The sensibility of this galvanometer was very great and it has been found possible to make very accurate determinations of resistance by its use together with the set. Its astaticism, however, rendered it very susceptible to magnetic disturbances and mechanical vibrations.

With a view to removing this susceptibility without detracting from the efficiency of the set, Messrs. Queen & Co. have been devoting



considerable attention to designing a new galvanometer for use with their sets. The galvanometer finally devised, and shown as a part of the set in the cut, is of the D'Arsonval type, very dead beat in its action, and remaining almost absolutely steady during all mechanical and magnetic disturbances. The set, fitted with this new galvanometer, may be used in factories where there is great mechanical vibration or in central stations, and in the vicinity of dynamo machinery where the magnetic field is very intense. In a test of the set, it was placed upon a violently shaken table and measurements made while the table was in motion. The measurements were easily and quickly made and were within an accuracy of 1-5 of 1 per cent.

The set with new galvanometer is particularly adapted for use in marine work, as the pitch and roll of the vessel will not appreciably affect the stability of the needle.

This new galvanometer is, like the astatic form, removable from the set and may be used separately for any kind of work desired. The astatic galvanometer has been improved by making the controlling magnet larger and completely removable from the galvanometer if desired. This galvanometer has also been so modified that it is practically impossible to break the glass covering the dial, a mishap sometimes occurring with the old type.

FROM NEWS CENTERS.

NEW YORK.

NEW YORK, SEPT. 12th.—Great interest has been evinced by the daily press this week in the Convention of the National Electric Light Association, at Montreal. The principal newspapers have every day contained long accounts telegraphed from Montreal, of the doings of the convention, of the attendance and of the entertainments provided by their Canadian hosts for the delectation of American electrical men. The electrical exhibition has been described as the most complete and interesting and thoroughly successful affair of its kind ever held on this continent.

Rapid transit matters are very little further advanced this week beyond the point reached last week, or the week before, or, in fact, the point reached several months ago. At one time the public was very much interested in the rapid transit question and followed the ponderous deliberations of the commission with some impatience, but during the last few months those deliberations have become so very deliberate that the public has lost faith in them, and now no longer even displays impatience. A sort of despairing hope still lingers that the commission will some day do something or other that will result in active steps being taken, but the general feeling is that what we now need is a commission to provide rapid transit for the Rapid Transit Commission. The Commissioners met yesterday to receive the reports of the four consulting engineers who have been making plans for the construction of the Broadway line, but the engineers have been enjoying their vacations and the reports were not yet in.

The annexed district—the extreme northern suburb of New York City—is still anxious for an electric railway worked by the overhead trolley system. An argument was held the other day before the commissioner; the company claims to have the consent of the necessary number of residents and permit from the Board of Electrical Control to carry out the work. The commissioner took all the papers and will give a decision later. The probability is that the line will be built without any further difficulty as it is badly needed. New Yorkers have seen very little of electric traction and will be quite proud to have an electric road even on the outskirts of the city.

G. H. G.

PERSONAL NOTES.

Col. L. W. Burnham, of Boston, has been in Chicago several days. He left this week for a short visit in Rockford, Ill., where he was well known away back in the fifties.

C. P. Rutty, of the McCreary Electrical Supply Company of New York, has been in Chicago for several days.

COMMERCIAL PARAGRAPHS.

The Germania Electric Co. reports business as being in a very satisfactory state. The demand for the improved Shaefer lamp is increasing rapidly, while in transformers and other devices handled, an increasing business is being done.

The chief office of the Consolidated Electric Manufacturing Co. is now in the Shawmut Building, 154 Franklin St., Boston, where Mr. C. E. Bibber, the general manager, is kept more than busy attending to the details of his growing business.

The Ashton Valve Co., of Boston, which does so extensive a business in its well known specialties with electric light and power companies, is now enjoying quite a boom with its new nickel seated pop safety valves which give unqualified satisfaction wherever used. Business in all branches is first-rate.

The Electric Gas Lighting Company, whose office and factory are at Boston, Mass., have recently opened salesrooms at number 20 Lakeside building, Chicago. Col. L W. Burnham, who has been the Company's vice-president and business manager for the past eight years, has been in Chicago the past week attending to the opening of the agency here. This company have a reputation of years standing for domestic electrical supplies, particularly automatic and hand gas lighting burners.

The Electric Engineering and Supply company, of 308-310 W. Jefferson street, Syracuse, N. Y., is sending out a handsomely illustrated catalogue describing the many different styles of sockets, cut-outs, switches, and other electrical supplies manfactured and handled by that company. A supplement to this catalogue is also being sent out from their railway department. This is devoted to illustrating and describing the many different forms of trolley wire insulators and other street railway specialties patented and handled exclusively by the company. Both catalogues contain many fine illustrations and are very credible productions.

The Chicago & Evanston Elevated Electric Railway was incorporated last week with a capital of $2,000,000. J. L. Cochrane, Alexander Clark and D. H. Louderback are mentioned as the incorporators, with the Edison General Electric Company as guarantee. This Company will work in conjunction with the Chicago & Evanston Electric Road, which was incorporated about three months ago by the same gentlemen. At that time the plan was to build an electric road from Evanston to some point near the terminus of the North Side cable, but this scheme has been abandoned, and the company has decided to run its road right into the centre of the city over an elevated terminal, the tracks to be elevated south of North avenue. The company will attempt to secure a terminus near State and Washington streets.

ELECTRICAL PATENT RECORD.

Letters Patent Issued Sept. 1, 1891.

DYNAMOS AND MOTORS.

458,618. Constant Current Dynamo. Ernest P. Clark, of New York, N. Y. Application filed Oct. 4, 1890.

458,617. Regulator for Constant Current Dynamos. Ernest P. Clark, of New York, N. Y. Application filed Oct. 4, 1890.

458,646. Electric Motor. Elihu Thomson, of Lynn, Mass. Application filed Feb. 2, 1887.
The chief object of this invention is to construct a motor which when supplied with current of constant potential will maintain a practically constant speed under varying loads, and to obtain this result with constant non-sparking points on the commutator and without the danger of causing by overloading a loss of magnetism in the field-magnets of the motor.

458,666 Automatic Cut-Out for Dynamo Electric Machines. Sidney H. Short, of Cleveland, O. Application filed Oct. 29, 1889.
The object of this invention is to provide a device which will automatically open-circuit the shunt-coils of a compound dynamo on the breaking of the external or working circuit, whereby when the external circuit is closed through a human body, as by taking hold of the broken ends in the attempt of repairing, a greatly diminished current will be generated and all danger to workmen will thus be avoided.

458,702. Electric Generator. John C. Henderson, of New York, N. Y.; Frederick Sargent, of New Rochelle, N. Y. Application filed June 21, 1890.

458,729. Electric Locomotor. Henry F. Shaw, of Boston, Mass.; George F. Shaw, of Dedham, Mass. Application filed Oct. 27, 1888.

458,856. Armature for Electric Motors or Generators. James F. McLaughlin, of Philadelphia, Pa. Application filed May 26, 1891.

458,869. Circuit Controller for Electro-Magnetic Engines. Charles J. VanDepoele, of Lynn, Mass. Application filed Feb. 3, 1891.

458,870. System of Supplying Current to Reciprocating Electric Engines. Charles J. VanDepoele, of Lynn, Mass. Application filed Feb. 26, 1891.
This invention relates to a system of supplying current to reciprocating electric engines, and more particularly to electric engines of the type operated by two forms of current—as, for instance, by a combination of alternating currents—and according to the present system the various types of currents are secured from an ordinary supply-circuit by the intervention of a current-modifying device at or near the point of consumption.

458,872. Electro-Magnetic Reciprocating Engine. Charles J. VanDepoele, of Lynn, Mass. Application filed March 19, 1891.

458,873. Combined Electric Engine and Pump. Charles J. VanDepoele, of Lynn, Mass. Application filed March 27, 1891.
According to this invention a magnetic piston is reciprocated within a pump-cylinder placed inside a motor coil or coils, and the piston itself is so constructed as to constitute the piston of a pumping engine, while the cylinder within which it is contained serves as the protecting casing interposed between the piston and the interior of the motor coils, the cylinder in this instance being diamagnetic metal and of correct bore without slits or other openings communicating with the coils and serving, therefore, as a cylinder, through which passes the liquids to be removed. The engine may be double-acting, and therefore capable of operation in any position, or it may be single-acting for vertical work. In either event the reciprocations of the magnetic piston are caused by the shifting of the field of force of the motor coil or coils, which is produced by successive waves or impulses of defined rising and falling current.

458,874. Reciprocating Electric Engine. Charles J. VanDepoele, of Lynn, Mass. Application filed April 7, 1891.

458,976. Electric Motor. Norton P. Otis and Rudolph C. Smith, of Yonkers, N. Y. Application filed Sept. 1, 1891.
This invention relates to a method of and apparatus for starting and controlling electric motors and more especially motors which are used to transmit motion to machinery for the transportation of goods and passengers, and which are necessarily obliged to be stopped and started quite often in their operation.

458,954. System of Reciprocating Electric Engines. Charles J. VanDepoele, of Lynn, Mass. Application filed Sept. 19, 1890.
This invention relates to an improvement in reciprocating electric engines, the same being an improvement upon the engine forming the subject matter of prior patent No. 307,884, dated Nov. 11, 1884.

RAILWAYS AND APPLIANCES.

458,582. Electric Railway System. Walter H. Knight, of New York, N. Y. Application filed July 3, 1888.
The combination of a number of generators connected respectively, to succeeding sections of an electric railway, with a number of electric locomotives on said railway, and means for reducing the current of any generator at the instant when a locomotive is leaving the corresponding section of road.

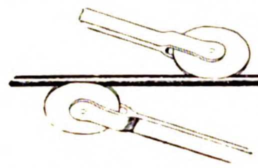
458,583. Electric Railway. Walter H. Knight, of New York, N. Y. Application filed March 13, 1886.
This invention relates to electric railways wherein the supply conductor or conductors are enclosed in a conduit; and its object is to avoid the objections which in many instances are attendant upon a conduit placed between the track rails, as well as to provide a suitable structure for the wires for each of two parallel roads. To accomplish this result, the inventor places the conduit outside the rail, and when equipping a double track road a conduit for the conductors of both roads is constructed and placed between the two tracks so as to be readily accessible for the collecting devices carried by the cars on the two roads.

458,584. Electric Motor Truck. Walter H. Knight, of New York, N. Y. Application filed March 5, 1889.

458,587. Electric Brake. John C. Lincoln, of Rochester, N. Y. Application filed Feb. 24, 1891.

458,620. Electric Trolley or Contact Wheel. Frederick E. Degenhardt, of Chicago, Ill. Application filed Nov. 21, 1890.

458,665. Electric Railway. Henry A. Seymour, of Washington, D. C. Application filed May 5, 1891.
This invention has for its object to enable the same conductor to serve for cars running in opposite directions on the two tracks. To this end the cars are provided with trolleys adapted to travel on a suitably arranged supply-conductor parallel with the double track when the said cars are on either track.



Patent No. 458,665—Double Trolley.

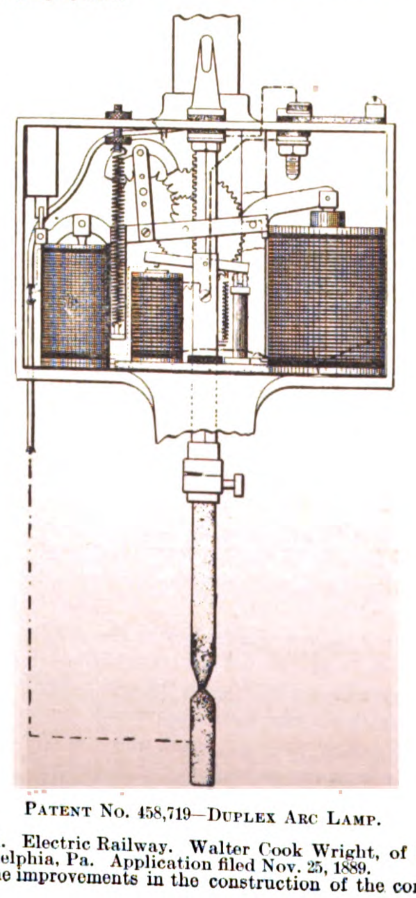
458,747. Electric Railway Conduit and Contact Device. Walter H. Knight, of New York, N. Y. Application filed May 10, 1888.

458,844. Electric Railway. Leon O. Dion, of Natick, Mass. Application filed Nov. 24, 1890.

458,867. System of Electric Railway Conductors. Charles J. VanDepoele, of Lynn, Mass. Application filed July 19, 1889.
The object of this invention is to prevent induction, this having been attempted in many ways without success, and so to speak, absorb the inductive effect of the electric-railways conductors, and in that manner prevent said inductive effect from extending to and injuriously affecting other circuits which may be in proximity thereto, as telegraph, telephone, fire-alarm, and others.

458,859. Method of and Apparatus for Operating Electric Railways by Dynamic Induction. Elias E. Ries, of Baltimore, Md. Application filed May 17, 1887.
The object of this invention is to overcome the difficulties of electric locomotion due to the direct communication of the source of electrical energy with the traveling motor, by substituting for the system involving such direct communication one in which the actuating current is generated by electro-dynamic induction, whereby it is possible to insulate the conductors proceeding from the generators in the most perfect manner which the art affords, to utilize currents of very high tension and comparatively small quantity, and to employ line conductors of inferior conducting capacity in surface and overhead and underground electric railway systems.

458,871. Telpher System. Charles J. VanDepoele, of Lynn, Mass. Application filed Feb. 28, 1891.
This invention relates to improvements in electric telpher systems—that is to say, a system of electrically-propelled vehicles in which a number of light carriages or cars are propelled along a specially-constructed way from point to point and started and stopped and otherwise controlled without direct manual intervention. Obviously, such a system might be organized so as to include passenger-carrying vehicles; but several of the novel features of the present invention relate to the automatic means whereby the train is started, stopped, and otherwise controlled, so that the description and claims refer more particularly to a package or freight carrying system.



Patent No. 458,719—Duplex Arc Lamp.

458,931. Electric Railway. Walter Cook Wright, of Philadelphia, Pa. Application filed Nov. 25, 1889.
The improvements in the construction of the conduit contemplate provisions for protecting the electric conductors and the contact rollers receiving current therefrom from access of drippings through the slot of the conduit, by locating the conductors and rollers upon such a plane with respect to the lower edges of the two depending aprons at opposite sides of said slot that any water entering the latter shall be directed downward below the line of possible contact with said conductors and rollers.

458,932. Electric Railway. Walter Cook Wright, Philadelphia. Application filed Nov. 29, 1889.

458,956. Controlling Dynamo-Electric Machines for Electric Railways. Sidney H. Short, Cleveland, Ohio. Application filed April 30, 1890.
This invention relates more particularly to automatic controlling means for preventing the overloading of the dynamo-electric generators in electric railways, wherein the motors on the different electrically-propelled vehicles are arranged abreast of or in multiple arc with one another.

CABLES, CONDUCTORS AND INSULATORS.

458,619. Conduit for Electric Railways. Frederick E. Degenhardt, Chicago, Ill. Application filed Nov. 21, 1890.

458,630. Conduit for Electric Railways. Emil E. Keller, Chicago, Ill. Application filed Nov. 21, 1890.

458,778. Electric Subway. John C. Reilley, Brooklyn, N. Y. Application filed May 19, 1891.

458,866. Closed Conduit for Electric Railways. Charles J. VanDepoele, Chicago, Ill. Application filed Feb. 8, 1887.
This invention relates to new and useful improvements in electric railways; and it consists in a new and improved arrangement whereby it is possible to place the main working conductor in a hermetically sealed tube or box, thereby effectually excluding water, snow and other injurious elements, the closed conduit being placed between the rails in the usual manner.

LAMPS AND ACCESSORIES.

458,718. Carbon Clamp for Electric Arc Lamps. Albert P. Seymour, Syracuse, N. Y. Application filed Jan. 3, 1889.

458,719. Duplex Arc Lamp. Barton B. Ward, New York, N. Y. Application filed Dec. 31, 1890.
The object of this invention is to provide a simple and effective means whereby the two sets of carbons may be caused to operate in the proper order one after the other.

458,876. Electric Arc Lamp. Barton Brewer Ward, New York, N. Y. Application filed Jan. 30, 1890.
This invention relates to improvements in electric focusing arc lamps adapted to be used in conjunction with a parabolic reflector of a search light; and the objects of this improvement are first, to provide an automatic focusing light in which there will be uniformity in the feed of the carbons at all angular positions, and second, to reduce the friction of the rods carrying the carbons.

458,987. Electric Arc Lamp. William A. Turbayne, Toronto, Canada. Application filed April 14, 1891.
Claim one reads:
"In an electric arc lamp, the combination of main and shunt magnets or solenoids, a lever pivoted intermediate of its extremities and connected at its opposite ends with the armature or cores of the respective magnets, and a ring-clutch for the carbon rod provided with lateral arms extending in opposite directions, one arm carrying a roller or other anti-friction device bearing upon said lever and the other arm carrying an adjusting screw the end of which also bears upon said lever, for the purpose described.

MISCELLANEOUS.

458,585. Telegraphy. David Kunhardt, Aachen, Germany. Application filed March 26, 1891.

458,603. Fusible Cut-Out. Charles S. Van Nuis, New Brunswick, N. J.; Jonathan H. Vail, New York, N. Y. Application filed Oct. 16, 1890.

458,625. Electro-Therapeutic Apparatus. William J. Herdman, Ann Arbor, Mich. Application filed Dec. 27, 1890.

458,652. Electro-Chemical Transformer. Turner D. Bottome, Hoosick, N. Y. Application filed Jan. 28, 1890.

458,653. Incandescent Lamp Cut-Out. Turner D. Bottome, Hoosick, N. Y. Application filed March 16, 1891.

458,656. Lightning Arrester. James P. Freeman, Washington, D. C. Application filed April 23, 1891.

458,716. Synchronizing Mechanism for the Second Hands of Clocks. Homer Munson, Mendota, Ill. Application filed March 3, 1891.

458,753. Protective Fuse. Hammond V. Hayes, Cambridge, Mass.; Anthony C. White, Boston, Mass. Application filed May 25, 1891.

458,755. Electric Meter. Maurice Koechlin, Belfort, France. Application filed Oct. 16, 1890.

458,879. Electric Switch. Adolph Wissler, St. Louis, Mo. Application filed June 22, 1891.

458,880. Casing for Electric Switches. Adolph Wissler, St. Louis, Mo. Application filed June 22, 1891.

458,947. Annunciator. William C. Dillman, Brooklyn, N. Y. Application filed May 6, 1891.

458,952. Electric Comb. John M. Riley, Newark, N. J. Application filed May 1, 1891.

458,953. Electric Comb. John M. Riley, Newark, N. J. Application filed June 22, 1891.

458,961. Testing Switch for Electric Circuits. Rudolph C. Smith, Yonkers, N. Y. Application filed Dec. 10, 1890.

458,964. Cleat for Electric Wires. Henry Price Ball, Brooklyn, N. Y. Application filed April 17, 1891.

458,977. Safety Device for Electric Elevators. Norton P. Otis and R. C. Smith, Yonkers, N. Y. Application filed Dec. 31, 1890.
The object of this invention is to provide means whereby the operators in the cage of an elevator may be notified of any change of the operation of the engine and to provide safeguards whereby to prevent a series electromotor from using an unnecessary amount of current beyond that required for the work which it is required to do; and to these ends the cage is provided with indicators, with means for operating it upon an undue change in the speed of the engine, and in case of an electrical engine means are provided whereby the operator in the cage can control the operating extent of the field magnet, and whereby friction is automatically applied to prevent any undue increase of motion of the engine.

ELECTRICITY.

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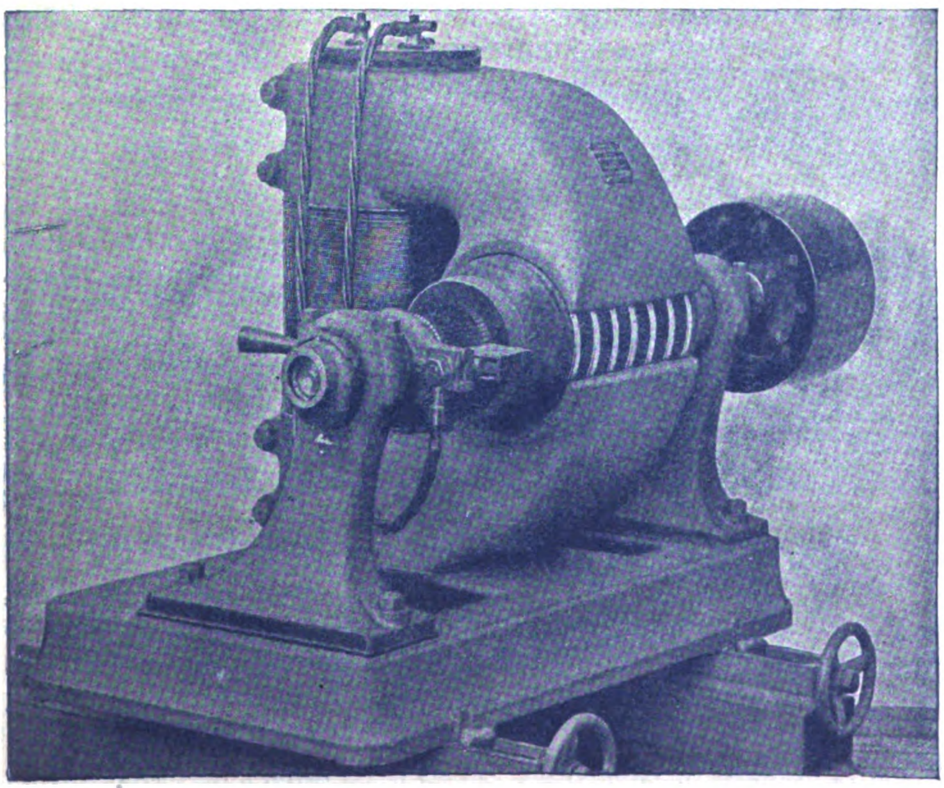

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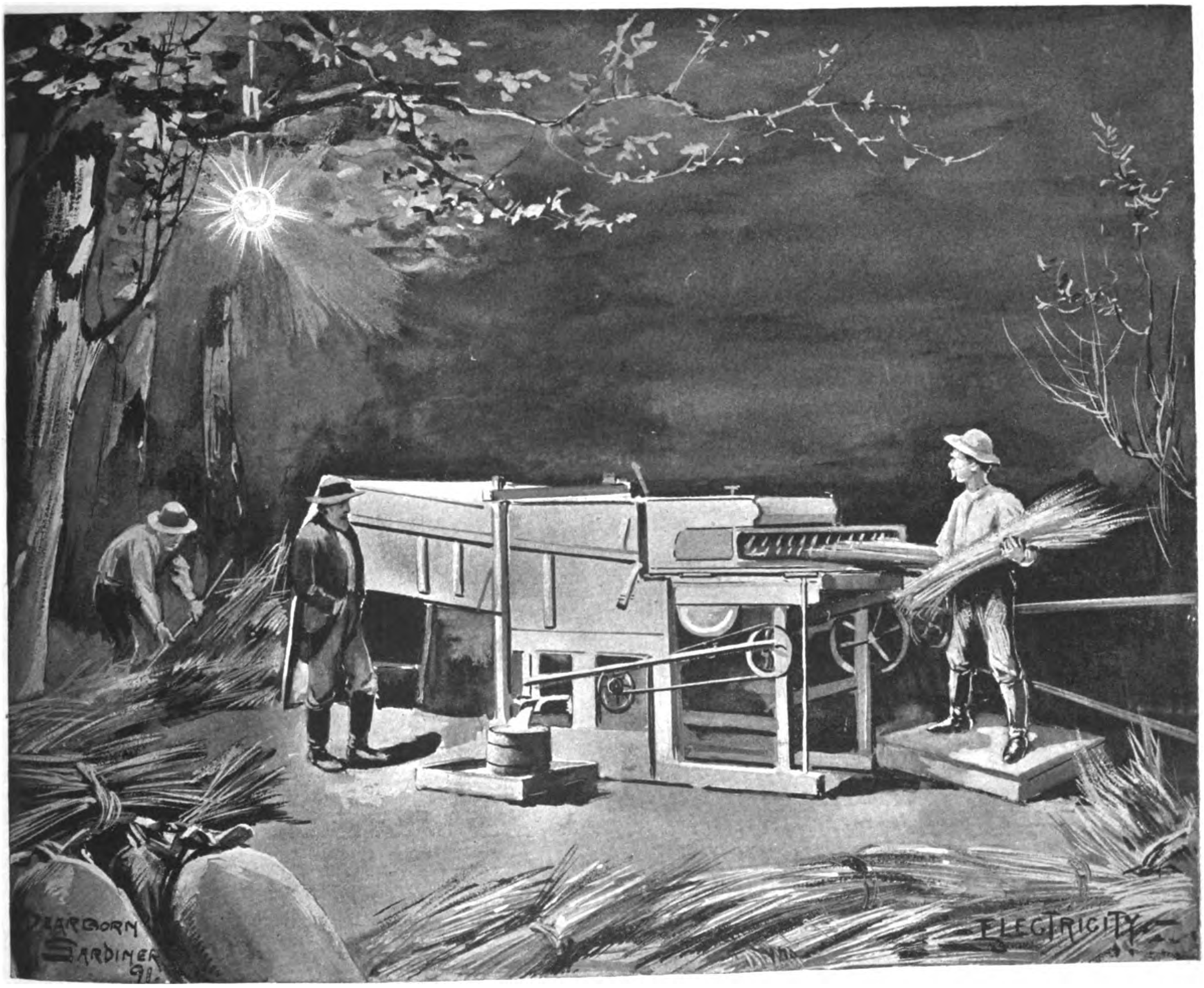


THRESHING BY ELECTRIC LIGHT.

HARVESTING BY THE ELECTRIC LIGHT.

Electricity has vocations in the green fields and on the hill-side as well as in towns and cities. Our frontispiece this week shows how effectively it is employed to lighten the labors of the farmer and lengthen the time at his disposal during the busy period of the year, when the harvest has to be got in shape for the market in the shortest time possible. With the electric light at command the days are twenty-four hours long instead of fourteen. The energetic farmer who keeps abreast of the times is not content merely to carry on his threshing operations by day, he also works through the night with the aid of the vivid rays of the arc lamp. How much this means to a farmer only a farmer can appreciate. Delays which would be caused by wet weather are avoided by taking advantage of dry spells and clearing off the work in double quick time. The proprietor of agricultural machinery for hire is also a gainer by this arrangement, as the earnings of his plant for a single season are greatly increased.

To farmers who keep only a comparatively small working staff the electric light comes as a boon and a blessing, because any single part of the work can be done, in a shorter time, and by proper organization the whole round of duties may be carried through very rapidly. As the machinery is always in use there is also a certain gain in economy of fuel, because the waste caused by periodically shutting down and getting up steam again is avoided.

We think it will pay electric light companies who are established in the neighborhood of agricultural regions to organize a portable electric light plant, which should be complete in itself and could be sent out at a moment's notice whenever required for such work as we describe.

TWO TELEGRAPH RELICS. THE FIRST MESSAGE OVERLAND AND THE FIRST UNDER THE SEA.

The Western Union Telegraph Company is endeavoring to secure, for exhibition at the World's Fair, the slip bearing the first message sent by Morse's telegraph as it actually was recorded by the instrument. This priceless relic is supposed to be in the possession of Major John Johnston, of Piqua, O. Major Johnston remembers having had the precious piece of paper tape, but so far has been unable to find it, although a thorough search among his papers has not yet been completed.

The story of the message is as follows: In May, 1844, Prof. S. F. B. Morse was experimenting in a room in the Capitol at Washington, provided free of expense by the government under an appropriation by Congress. His line then extended from Washington to Annapolis, Md. At that time delegates to the Whig Convention were arriving in town, and among them was Maj. Johnston. Mr. Kirk, now of the Western Union Company, took him into Prof. Morse's private office, where he was cordially greeted by the Professor. The latter, after some conversation, said to him: "Maj. Johnston, I have sent a friend to Annapolis who will attempt to send a message to me on the wire. Just wait and listen to it."

Pretty soon the little instrument began ticking. Prof. Morse read off the signals to Maj. Johnston and Mr. Kirk. As the instrument stopped Morse cut off the slip and handed it to Mr. Johnston, who took out his pocketbook and placed the message, now historical, carefully in it. The message, as Mr. Kirk recollects it, expressed the pleasure of the sender at being able to reach Prof. Morse over the wire.

When Maj. Johnston and Mr. Kirk dig out the original message it will be handsomely framed by the Western Union Company and be given the most prominent position in its exhibit at the World's Fair.

This message apparently antedates that famous and most happily worded dispatch "What hath God wrought," which was sent by Miss Anne G. Ellsworth (now Mrs. Roswell Smith), in the same month, May, 1844. This latter message was sent from Washington to Baltimore, whereas the message said to be in the possession of Maj. Johnston was probably sent before the line to Baltimore had been completed.

Another telegraphic relic of the same nature which should be exhibited at the World's Fair can probably be obtained from the Duke of Wellington. This is the original slip of the first message that was sent from one country to another through a wire laid under the sea. Such a relic, in the light of the wonderful development of submarine telegraphy, certainly equals in historical interest the first message sent by Morse's telegraph. Early in the year 1850 the first submarine cable was laid between England and France. The cable consisted merely of an insulated wire without any external protection, and it was hastily made and laid so that telegraph communication between the two countries might be established, even if only for a few hours, in order to save the franchise, which was about to expire. Mr. F. C. Webb, the veteran submarine cable engineer, was then a midshipman in the Royal Navy, and his ship being anchored off Dover when the tug started to lay the cable toward Calais, he secured permission to accompany the expedition. The wire was laid down without mishap, leaden weights being attached to it at intervals to sink it to the bottom.

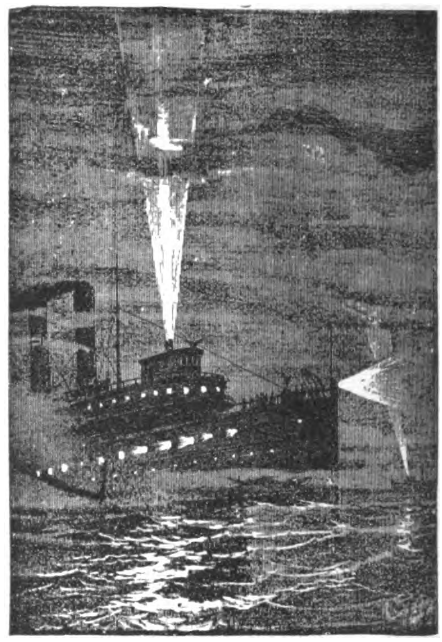
When the instruments were connected up it was found that the cable answered its purpose admirably and the tape soon began to flow forth at the receiving end. Those in charge of the line were about to destroy the slip, but Mr. Webb, being of an archeological turn of mind, and foreseeing that one day such a relic would have great historical interest, carefully folded up the piece bearing the first message and labelled it for preservation. The cable only lasted a few hours, as on the following day a French fisherman picked it up with his anchor and straightway chopped it in two.

The famous Duke of Wellington was at that time Lord Warden of the Cinque Ports, and was residing at Walmer Castle, near Dover. During a visit to the commander of Mr. Webb's ship, the Iron Duke heard of the relic which Mr. Webb had secured and expressed some interest in it, and the result was that the relic changed hands, Mr. Webb making a present of it to the Duke.

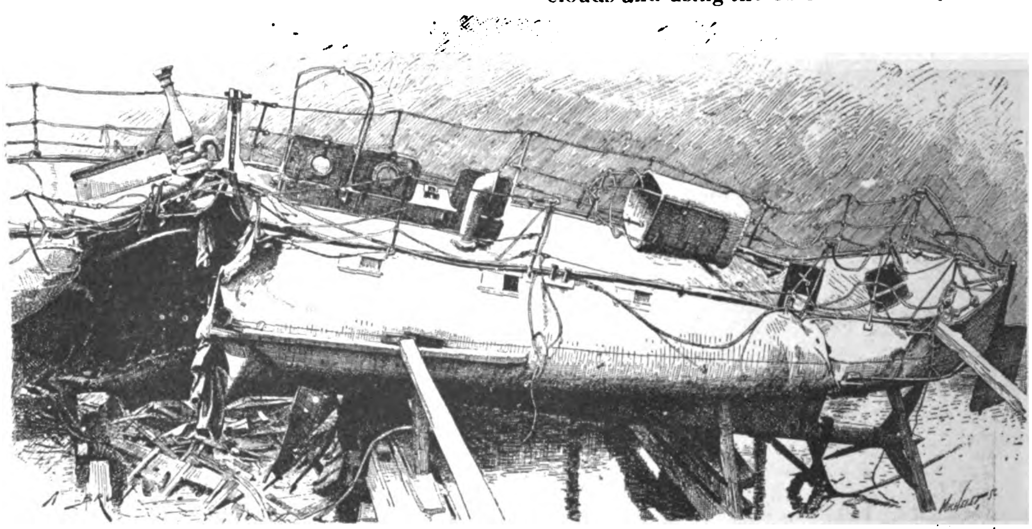
It is well known that the famous general preserved his papers and other possessions in the most systematic manner, and it is probable that the present Duke of Wellington will be able to find the message and would no doubt lend it for exhibition at the World's Fair, if asked to do so.

THE USE AND MISUSE OF SEARCH LIGHTS.

Following up the subject of the use of projectors on board ship, which was so ably treated in our last issue by Lieut. Hamilton Hutchins, U. S. N., we present this week two illustrations in which the search light plays a part. One of these depicts a very useful application of the projector and the other the disastrous results of a too free use of the same instrument during a sham naval battle.



Naval projectors are fitted with a shade, which, by moving a small lever on the outside of the cylinder, can be manipulated so as to cover and reveal the arc. In this manner the projector can be used for signalling at night between two or more vessels, or between a vessel and the shore. For signalling in this way the Morse code is used, short flashes representing the dots and long flashes the dashes. By displaying and shutting off the beam directed against the clouds and using the Morse code of signals, com-



"Wreck of the Edmond Fontaine."

munication has been maintained between two vessels at sea separated by a distance of sixty miles.

The second illustration shows in a graphic way what may result from the misguided use of projectors in naval manœuvres. The torpedo boat "Edmond Fontaine," 125 feet long, and having on board a crew of twenty officers and men, was engaged in an attack on the harbor of Cherbourg during the French naval manœuvres this summer. In the heat of the battle the "Fontaine," which belonged to the attacking fleet, attempted to pass in front of the "Surcouf," one of the ships defending the harbor. The "Surcouf" rammed the "Fontaine," with what force can be seen from

ELECTRICITY

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AS will be seen from the letter of our San Francisco correspondent in this issue, a great deal is being done in electric traction on the Pacific Coast. At the same time, judging from the number of lawsuits and other disputes referred to, there seems to be a lamentable want of harmony among those in control of the street railway systems in that part of the world.

* * *

PROFESSOR HOUSTON'S paper on "Artificial Rain-making" summarizes in a scientific manner the subject which has excited the ridiculous discussion in the current number of the *North American Review*. This article will form interesting reading in connection with that by Mr. Jennings, as in one instance they touch on the same ground. Prof. Houston's suggestion of establishing electrical meteorological stations by means of captive balloons is one decidedly worthy of adoption.

* * *

MR. SPRAGUE brings to a conclusion this week his charming reminiscences of pioneer electric railroading. As one reads this story, bristling with trials, experiments and vicissitudes at every turn of the wheels, so to speak it is difficult to believe, so rapid has been the subsequent development of electrical railway construction, that the contract for the Richmond road was signed barely four years ago.

The little appendix to Mr. Sprague's article gives some idea of the extension of electric traction, as it shows his assistants of four years ago now scattered all over the country with different electric railway companies, some of which came into existence long after the Richmond road was doing regular service.

THE weekly London journal, *Nature*, than which there is none of higher scientific standing in the English or any other language, quotes and tacitly endorses the editorial on the suggestion for an electrical congress at the World's Fair which appeared in ELECTRICITY for August 26.

ELECTRICITY, though young, is vigorous, and during its short career has been widely quoted by technical journals of high standing both in this country and abroad. This is proof of the value of our columns which can but be appreciated by our readers as well as by ourselves.

* * *

DISCUSSIONS on telephonic matters are now very active in England. At the recent meeting of the British Association, Mr. W. H. Preece read a paper on the London-Paris telephone line, and Mr. A. R. Bennett read another with the atrocious title, "The Telephoning of Great Cities." Mr. Preece made an excellent report on the London-Paris line, which is a complete success, both electrically and financially. Mr. Bennett proposes to deal telephonically with large cities by dividing them up into districts of one square mile, with an exchange in each district, to be worked by a modification of the Law system, so well known in this country. He makes various comparisons between the working of this system and the American multiple system, some of which, of course, are incorrect, notably when they deal with the trunk wire connections. The difficulty with most telephone schemes is to make them work actually as well as they do on paper, and we question very much whether the ambitious scheme of Mr. Bennett, if attempted on the lines laid down by him to accommodate, say, 100,000 subscribers, would be an exception to this general rule.

In the discussion on the papers read by Mr. Preece and Mr. Bennett, the distance over which telephonic communication is carried on in this country was referred to, and incorrectly stated. For the benefit of our English readers we may say that speech between Chicago and New York has been exchanged, but only experimentally, and the distance between the two points is 980 miles, not 800. The regular service of the Long Distance Telephone Company, provides communication between New York and Buffalo, a distance of about 480 miles. This is the longest telephone circuit in daily commercial use in the United States.

* * *

CARLYLE says, "We call that fire of the black thunder-cloud 'Electricity,' and lecture learnedly about it, and grind the like of it out of glass and silk; but what is it? What made it? Whither goes it?" In this issue we publish an article by Mr. W. N. Jennings containing information which the auther hopes will be valuable in answering such queries as those propounded by Carlyle.

Mr. Jennings has photographed "the fire of the black thunder-cloud" and also the "like of it" ground out of "silk and glass." The subject that may appropriately be termed "photo-electrics" is a broad one, and Mr. Jennings, who is an enthusiast in the field, holds that what has been already accomplished is interesting to-day and will be valuable in the future; an opinion which we strongly endorse.

He describes in his article the means he has adopted for securing photographs of lightning flashes, and presents a number of exceedingly interesting pictures, illustrating the several kinds of flashes which he has been able to secure. We venture to say that these pictures of the remarkable vagaries of lightning have never been equalled, and certainly not excelled, in interest, by anything of a similar nature hitherto published.

The series of questions which Mr. Jennings propounds at the conclusion of his article will, he believes, eventually be answered by students in photo-electrics. To all who have a bent in that direction we feel confident that this article will be a stimulant to further effort.

* * *

A PARAGRAPH is going the rounds of the daily papers just now to the effect that someone has solved the problem of telephoning between America and Europe. Although it is legitimate to believe, in view of the wonderful advances that have been made in long distance telephony, that such a feat will eventually be accomplished, yet at the present time and with our present knowledge, the obstacles to be overcome appear absolutely insuperable. To show how much this is so it may be stated that the shortest ocean cable between the American continent and Europe, and that having the best electrical conditions, is, electrically speaking, about 400 times more unfavorable than the longest circuit of the same type of cable over which it is possible to carry on telephonic communications to-day. From this it would seem that telephonic communication between America and Europe is an apparently hopeless task.

* * *

IT frequently happens that electrical men on both sides of the water are, in the heat of discussion, or under the perverting influence of the newspaper reporter, led to make odious comparisons between the accomplishments of electrical engineers in their respective countries. As a general rule these communicative gentlemen claim that every discovery and every improvement is due to the inventive genius and energy of their compatriots, and that those who have the misfortune to struggle for existence on the other side of the Atlantic are far behind the times.

Such outbursts as these, which have of late become alarmingly frequent, partake neither of good sense nor of good taste. It is indisputable that the Anglo Saxon race has been more prolific in devising original applications of electricity than the peoples of any two other countries under the sun, but it is absurd to argue that in every one of these applications one branch of the race is always in the van and the other in the rear.

Such claims are frequently made and disputed, and a peculiarly flagrant case in point is found in some remarks made by Prof. Silvanus Thompson, in a discussion on telephone papers at the recent meeting of the British Association. Prof. Thompson said that "They were so apt to think that American electricians led the way because they said so, and occasionally they were believed for want of further information. Now, the fact was, that the English led the world in telephonic work, and not the Americans."

As a matter of fact, American electricians have every reason to pride themselves on leading the way in the adoption and development of the telephone, and Prof. Thompson's statement is entirely wide of the mark. We may add that this little speech has by no means been appreciated in England, as will be seen from the comments of *Engineering* and of the *Electrical Review* (London), which we reproduce this week.

our illustration, (which is after a photograph made by M. Jules Desrez, of Cherbourg), and the unlucky vessel sank in thirteen fathoms of water.

The cause of the collision was that the projector of one of the other ships of the defending fleet was kept steadily directed on the torpedo boat. The commander and quartermaster of the "Fontaine" were blinded by the dazzling rays and could not distinguish the surrounding vessels nor judge distances correctly. Believing himself to be farther away from the approaching ship than he really was, the commander of the "Fontaine" kept on his course, running straight across her bows, and his boat was rammed almost dead amidships.

THE STORY OF THE RICHMOND ROAD.

BY FRANK J. SPRAGUE.

PART III.

Saturday, May 4, 1888, was an important day in our calendar. Till then the number of regular cars on duty had not exceeded twenty. On that day, at 4 P. M., the hour when traffic became exceptionally heavy, we began putting out ten open cars, starting them from the eastern carhouse, alternating with the closed cars, but finally banking them all up, near the western terminus. At 6 P. M., they were started home, and shortly afterwards these ten open cars, headed by a closed car, were all run at full speed, close together, down the east-bound track of Clay street. At one time fourteen cars were on the line between Clay and Hancock streets and the Old Reservoir, and shortly before 7 o'clock there were about twenty-two cars on the line between Capitol Square and the Old Reservoir, and at 7 o'clock thirty cars were on the line, the closed cars being very heavily loaded, and many of the cars being run at two-minute intervals. The three boilers, whose capacity was 375-horse power, were then supplying three Armington and Sims engines of 125-horse power capacity, which were driving the six railroad dynamos, and two Westinghouse engines of 110-horse power capacity, which were driving two alternating current dynamos and exciters, with an equivalent load of 1,060 incandescent lamps. The firing became pretty active, there being in addition to the thirty cars badly banked, about 110-horse power taken for lighting.

The highest normal reading on the line, however, was less than three-quarters of the regular capacity of the dynamos, which were originally intended for only thirty cars, and the average reading for this number was only a trifle over half the normal capacity. This test settled conclusively all question as to the distance, speed and power, and it was particularly interesting because circulars were about that time issued in favor of a series system of operation, in which it was stated that two-thirds of the number of cars thus operated on a multiple arc system would require about ten times the power actually used for the thirty cars. It is almost needless to say that on that day we felt that we owned the street, and we owned the city. Fatigue and worry were all forgotten in what was, to us, a supreme moment. Subsequently, one of the most beautiful sights which I for a long time witnessed was the assembling of about sixteen cars at night, all lighted up, in the very center of the town. It was as much an accident as anything. Burt had given orders for certain cars to wait until the closing of the theatre. The two or three cars required had waited, the entertainment was late, and the other cars came up. The first lot had their orders and they did not move except to give the new comers room. This continued until the number congregating made everyone enthusiastic, and Burt said let every one wait, and wait they did. When these sixteen cars finally began to move, each one taking its position, they seemed almost imbued with life, and we could hardly repress a cheer, so invigorating was the sight.

The other most important experiment of banking the cars occurred one night on the occasion of a visit to Richmond of President Whitney and a number of directors of the West End Railway of Boston, then considering the adoption of the cable. We had been in the habit of letting the cars bank up at the eastern terminus, leaving them in the street for want of better shelter. On this particular night, at a little after midnight there were about twenty-two so collected. General Manager Longstreet, of the West End road, had expressed doubts as to the possibility of handling the cars electrically when badly bunched. Bent and I talked it over, and I made up my mind I would settle that doubt. So about midnight we called at the hotel, and sent word up to Mr. Whitney, who had retired, that although the line was not erected for any such fantastic operation, I would make the attempt to move all the cars if he and Mr. Longstreet cared to see a doubtful experiment.

Mr. Whitney is energetic, if anything, and we were soon on our way out to the eastern sheds, about two miles from the station. I had first gone to the engineer, telling him to load the eastern feeder catches, to raise the pressure to 500 volts, and to hold it there no matter what happened. He did so, and it was a good thing he did, for when, at the wave of a lantern, twenty-two motor-men started their cars over a section of line designated for four distributed cars, the potential on the line dropped to about 200 volts, then gradually rose, and all the cars were soon merrily running out of reach of signals. This was conclusive, and the fate of the cable in Boston was settled.

Richmond was prolific in new experiences, which by their variety and number taxed our resources to an extent happily unknown on more modern roads. Many of the difficulties we experienced were not inherent in the machines, but were either caused or augmented by conditions over which we had no control. One of the most annoying of these outside causes was that the cars frequently jumped the tracks. A large portion of the track was, as has been stated, laid in macadam and dirt streets, the latter being chiefly in new districts, and in soil of which the chief component was red or yellow clay; and although the curves were of sharp radius, only one guard rail was used, and this was not bound in by paving. The winter months brought frequent and heavy rains. The tracks were found to be settling out of sight in mud, and at the curves they were spreading. The cars being large and heavy, with a 4-foot 8½-inch gauge and a 6-foot wheel base, helped to make the curves spread, owing to the tangential pressure of the forward wheels on the outer rails. Mud and stones would get into the grooves, and the cars, having a tendency to go straight ahead instead of being pulled around by the head as with horses, would climb the track, and before an inexperienced man could check them, the wheels were down five inches in the mud alongside the stringer pieces, and track brakes hard and fast against the tracks. Sometimes it was lifting, sometimes prying, and sometimes a heavy, hard pull on the part of the motors to get them back again.

Since scarcely a trip was at one time made without jumping the track, a heroic treatment was at first adopted which gave the cars the appearance of battering rams. Heavy pieces of of timber about twelve feet long and scaling ladders were carried underneath the car bodies. When the car left the track, and tried to bury itself in the mud, all hands, often including the passengers, manned the stick, and, aided by the motors, hoisted the car back into place. Gradually some of the soft places were filled up with cinders, the track rectified, the curves paved, and we soon learned that with care a car could be backed onto the track by using track plates and completing the ground circuit by a flexible cable, which we called an "electric kedge." That nautical terms were so freely used at Richmond to express uncommon experiences is perhaps not to be wondered at.

The bugbear of sleet and snow was freely raised and in view of the condition of the tracks this was not extraordinary. It was impossible to keep them from being thickly covered with mud, often thrown up by passing vehicles, and when a sharp change of weather occurred at night, the next morning afforded opportunity for the cars to play leap frog accompanied by pyrotechnic displays. And Virginia mud clung hard to cold iron. It was no infrequent thing to have to cut through clay, snow and ice, when the tracks were completely out of sight. I remember well one of the worst nights of that winter, when I had gone to bed utterly played out, after an almost vain attempt to get the "Snow Flake," a construction car so named in derision, up a six per cent. grade on a slippery track, with only one motor available. I had finally left it in the street ready for the morning's work. The dawn brought dismay. Tracks, trees, trolley-wire were all covered with a heavy sleet. Not a car was in operation, and apparently everything looked hopeless. In desperation I got on board my pet, swept off some of the snow, mopped off the motors so there was only a moderate display of leaks, and started to make the best of my way to the car house. The sun had come out and water was beginning to drip from the pendant icicles, when as I turned the corner of the head of the Franklin Street grade, my eyes were gladdened with the sight of a car slowly climbing the ten per cent. grade, and Pat on top with a broom clubbing the trolley wire and making the sleet drop off in great lengths. That settled the sleet question, and we gave ourselves no more concern on that account.

Thunder storms, however, which are particularly severe in Richmond, brought us new anxieties, and the result of the first attack was awaited with interest. The length of overhead circuit, the unguarded condition of the poles and wires, and the numerous ground connections afforded by lamp and motor circuits invited frequent discharges, but like many other anticipated dangers, our apprehensions, so far as they related to danger to life, were quickly allayed. In one of the first storms, lamps were broken, several field magnets were grounded, and switches burnt out. On one occasion three darkeys were sitting on the rear platform, one with his legs probably dangling over a switch, when a sharp flash was seen, accompanied by a peculiar report in the switch beneath him where the discharge jumped to the earth. More frightened darkeys have seldom been seen than these three passengers as they disappeared up the street. As a rule, however, we experienced little personal difficulty on this account. Passengers often did not know when the lightning discharged through a car circuit—or if they did, they rapidly gained confidence. Finding that the lamp circuits offered a free path, while the fields acted somewhat as choking coils, we for a time directed lamps to be lighted on the approach of a thunder storm, ostensibly to light the car, as was carefully explained to timid lady passengers. The armatures being on the ground side of the circuit were rarely injured, the discharge forcing its way to earth at some weak point of the fields. The number of lightning arresters devised which did not arrest this somewhat erratic force were many.

But enough of reminiscences for the present. I look back with pleasure to the Richmond days, and with many an affectionate remembrance. The company I organized grew and prospered. It left its stamp on, and played a good part in the development of a new industry, and now that it

has been absorbed into a great financial organization, and the work has acquired more of a routine character, I find pleasure in turning for a time to new fields.

Most of my associates have scattered from the old fold, but they hold responsible positions in the railway field, their personality and experience stand them in good stead, and I feel a pardonable pride and kindly interest in their careers.

HOW MR. SPRAGUE'S ASSISTANTS HAVE PROGRESSED.

It is interesting to note, in connection with Mr. Sprague's reminiscences of the conversion of Richmond to electric traction, how the little band of pioneers who were his co-workers in that arduous and eventful undertaking have spread themselves out over the land. They are now to be found occupying prominent positions in almost all the companies which are at present engaged in the construction of electric railways. The names that occur in Mr. Sprague's animated narrative have now the following responsible titles attached to them:

Mr. S. Dana Greene is assistant to the Second Vice-President of the Edison General Electric Company.

Mr. Oscar T. Crosby is the manager of the Railway Department of the Thomson-Houston Electric Company.

Mr. John Mann is the manager of the Railway Department of the Edison General Electric Company.

Mr. Henry McL. Harding is manager of the Railroad Department of the Westinghouse Electric and Manufacturing Company.

Mr. J. L. Barclay is the principal agent of the Westinghouse Company, with Mr. Harding.

Mr. Charles A. Benton is the manager of the Railway Department of the Detroit Electrical Works.

Mr. E. E. Higgins is manager of the Short Electric Railway Company.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the fifty-ninth meeting of the American Institute of Electrical Engineers, held in New York last week, Prof. Harris J. Ryan read a paper on "The Relation of the Air Gap and the Shape of the Poles to the Performance of Dynamo-Electric Machinery."

Up to the early part of last year, when the subject was attacked by Messrs. Swinburne and Esson, the air gap was usually treated by contributors to electrical literature as an evil in a dynamo, having a necessary existence, and they held that the smaller it could conveniently be made the better. The shape of the poles had often been spoken of as having a somewhat decided effect on the performance of the dynamo, while but little had been said regarding the cause of such an effect.

Prof. Ryan presented a quantity of data, obtained by actual experiment, showing that it is useless to attempt to diminish the air gap beyond certain limits; and that the best results are obtained, as regards magnetization, when the field magnets are constructed with strengthened instead of taper pole corners.

A NOTEWORTHY ENTERPRISE.

The tunnel under the St. Clair River is a magnificent piece of work, and its inauguration was a notable event of this tunnelling age. The Grand Trunk Railway deserves all praise for its splendid enterprise in constructing at immense cost, a tunnel over 6,000 feet long, with the sole object of saving two hours in the time of transit over its lines.

JOVE'S AUTOGRAPH.

HOW HE WAS INDUCED TO WRITE IT ON THE PHOTOGRAPHIC PLATE.

BY W. N. JENNINGS.

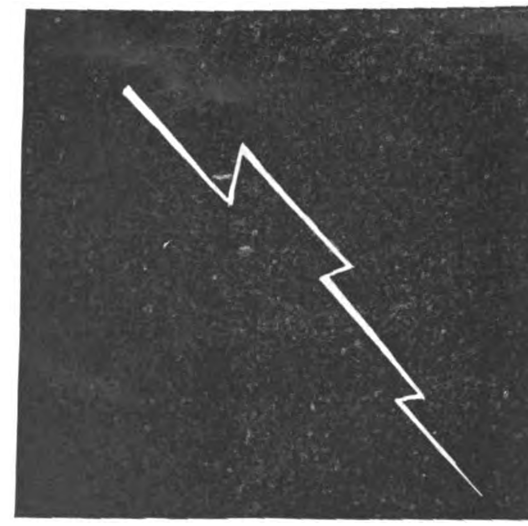
A vivid streak of light tearing its way through the darkness; a sudden gust of wind bending the trees before it; a fearful peal of thunder like the roar of an angry monster, then the rattle and hiss of rain as it dashes upon the housetops. Such is a thunder storm.

About ten years ago, when looking at a celebrated painting representing a storm, I wondered why the artist had depicted a flash of lightning as a sharp, angular, zig-zag line.

Upon examining a great number of pictures where lightning was delineated it was noted that the angular form was universally accepted. Having been a close observer of thunder storms for many years, and failing to receive such an impression upon the retina, I thought, perhaps, the eye was at fault. A discharge of lightning always appeared to me as an irregular wavy line, sometimes having numerous branches shooting from a main stem.

It occurred to me that perhaps Jove might be induced to decide the matter by leaving his autograph upon the surface of a photographic plate. To accomplish this was the next question. To attempt the feat of photographing lightning, with an instantaneous shutter, during day-time was, of course, out of the question. The problem solved itself. One night in the summer of 1883, during a very severe thunderstorm, I climbed out on the roof of the house and set up a camera. A sudden gust of wind almost carried instrument and operator into the street. The tripod was dispensed with and the camera was anchored to the roof by two or three bricks; a distant gaslight furnished a good focusing point. An instantaneous plate was placed in the camera, the lens pointed toward the sky in the direction where the electric energy was most active, the slide withdrawn, the lens uncapped, and just then a blinding discharge of lightning flared up in front of the camera, with a veritable hiss, followed immediately by a ripping, tearing peal of thunder.

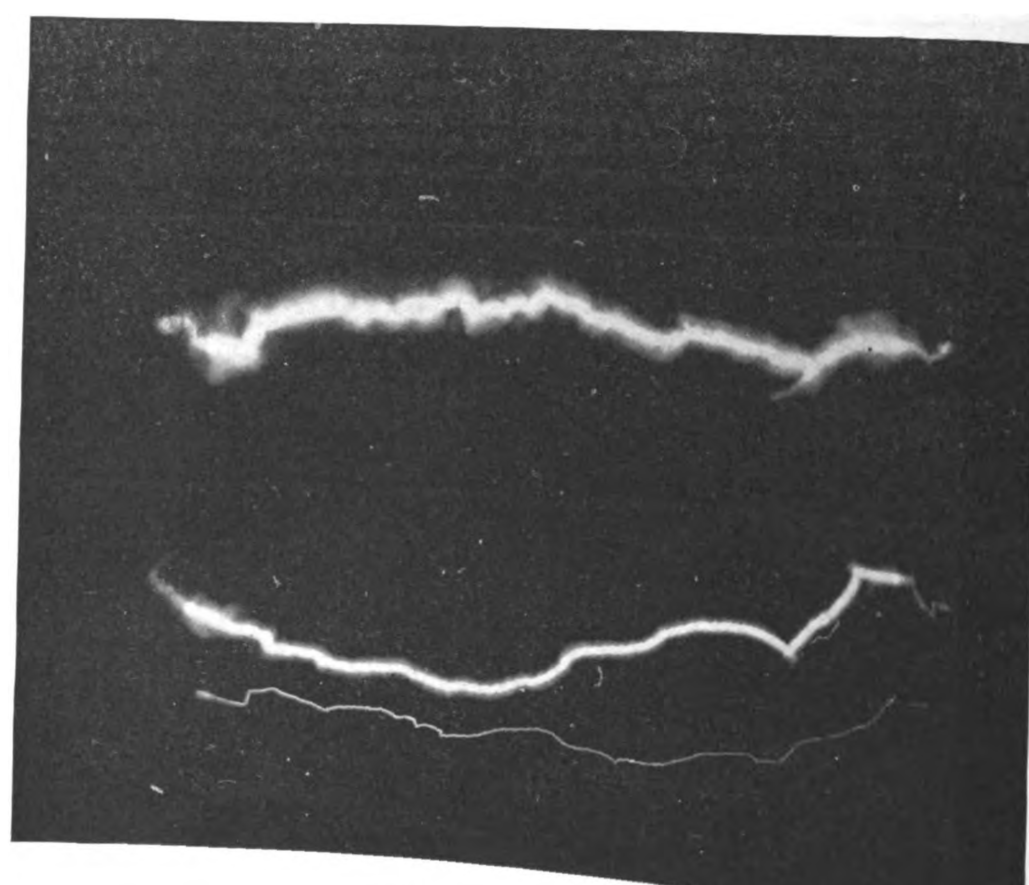
Half blinded, I staggered to the dark room and developed a fine section of night without the slightest trace of Jove's fire-works. Many other attempts were made without results; but in September, 1883, I managed to get a photograph showing very faintly a small discharge between two clouds. Thus encouraged, the work was taken up with renewed interest. Over one hundred plates were exposed at different times, but not until August 1, 1885, did success crown my labors.



CONVENTIONAL ILLUSTRATION OF LIGHTNING.

At midnight a terrible thunderstorm passed over Philadelphia. Not having any instantaneous plates on hand, the camera was loaded with a "slow" plate. After making the exposure to an extremely vivid discharge of lightning I found that the only developer on hand was some old "oxalate," which, like the plate, was very slow to act. After prolonged development without any signs of lightning on the plate, it was left to soak for about an hour, at the end of which time I was delighted to find upon the surface of the plate a sinuous line with numerous branches extending from zenith to horizon, with the image of trees and houses plainly outlined in the foreground.

Since that time my little camera has faced many storms, and success is certain almost



ARTIFICIAL LIGHTNING.

time. Last year I managed to catch a photograph of Jove's handiwork which clearly explained all the previous failures. It was a long wavy line of light with numerous *dark* branches. At first it was thought that these branches represented portions of the discharge of a different color, or having less actinic power than the main stem; but a simple experiment offered a better and probably a true solution of the problem.

SINUOUS VERTICAL DISCHARGE, TAKEN AUGUST 1, 1885.

It is well known that in an instantaneous photograph of the sun the image is represented as a dark disc. If the exposure is prolonged the image is again reversed, showing a light disc; but the image of the sky has also reversed itself, printing dark in the positive.

In all previous experiments I had used very sensitive plates and strong developers. The discharge of lightning was so intense as to reverse its image on the plate, but the sky not being illuminated sufficiently had made no impression upon the plate. The result was that the image of lightning was a dark one on a dark ground. An ink line on a blackboard—nothing.

The use of glass plates has been discarded in this branch of photography, as the reflection from the back of the glass is liable to give a double image. Celluloid films are better, as they have no reflecting surface. A hand camera is best adapted to the work, as it is found impossible to set up and retain a tripod in position during a severe thunderstorm, especially when the electric fire blazes overhead.

It is well to select a point from which a clear sweep of the horizon may be had; don an old wet weather suit, load the camera and sally forth at the approach of a thunder storm. The active energy of the storm passes away very quickly. The storm usually furnishes light enough to allow the operation of attaching a plate holder to the camera, or to note the indicator of a roll holder.

VERTICAL SINUOUS DISCHARGE.
SHOWING A MINOR HORIZONTAL DISCHARGE ATTRACTED BY THE MAIN VERTICAL DISCHARGE. ALSO STRATIFICATION OF THE MAIN STEM. TAKEN JULY, 1887.

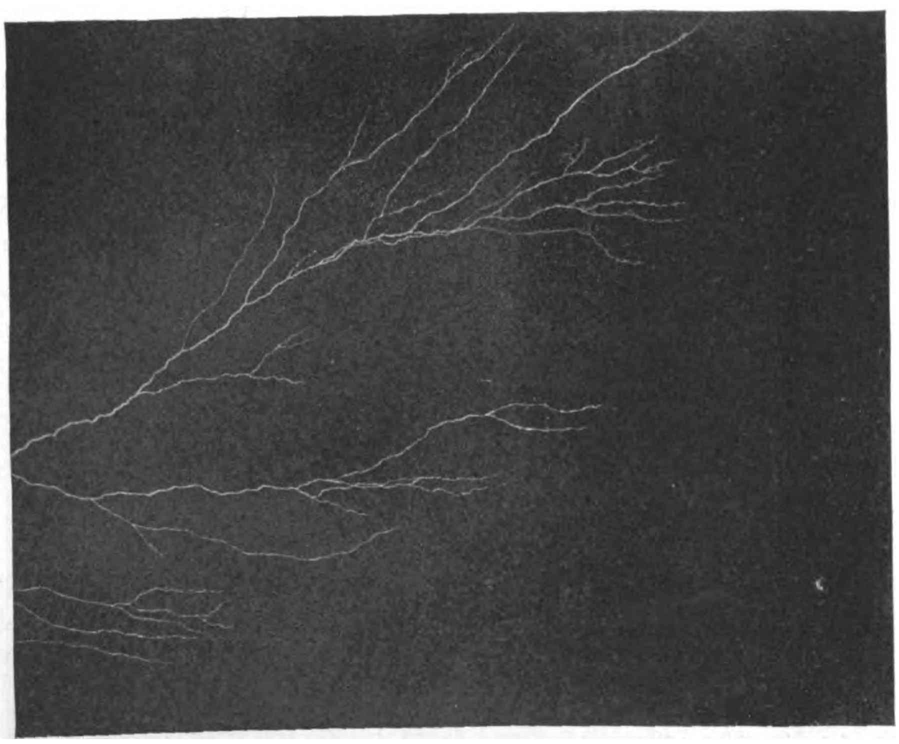
Lucifer matches are out of the question. A few lightning bugs imprisoned in the corner of a handkerchief and shaken a little when light was wanted answered the purpose admirably last summer.

In 1884 a number of photographs of "artificial lightning" were made, to identify the contour and character of the electric spark with lightning, a group of which are reproduced for comparison. The increase in thickness is due to the addition of condensers to the Holtz machine.

Immediately after a thunderstorm it is well to make a sketch of the discharges of lightning photographed, as they appeared to the eye, with notes as to the time elapsing between the discharge and the ensuing thunder-clap, for comparison with the subsequent photograph. By adopting this course it is wonderful how the eye becomes educated to see, and the mind to grasp, the true form of instantaneous phenomena.

Perhaps, if the subject is followed up carefully, the camera will unravel many tangled knots and give to the mind a definite impression concerning that strange something which we now call electricity, and probably afford an answer to the following questions:

What is lightning?
Its cause?
Duration of a flash?
Its variety?
Cause of variety?
Is there such a thing as a "thunderbolt?" If so, in what way does it differ from the ordinary form of lightning, and why?



TREE FORM OF DISCHARGE (VERY RARE), TAKEN JULY, 1887.

DIVIDED DISCHARGE, TAKEN AUGUST, 1886.

Did Franklin "draw lightning from the clouds" or was it merely an inductive discharge from the earth?

What is the average length of a lightning discharge?

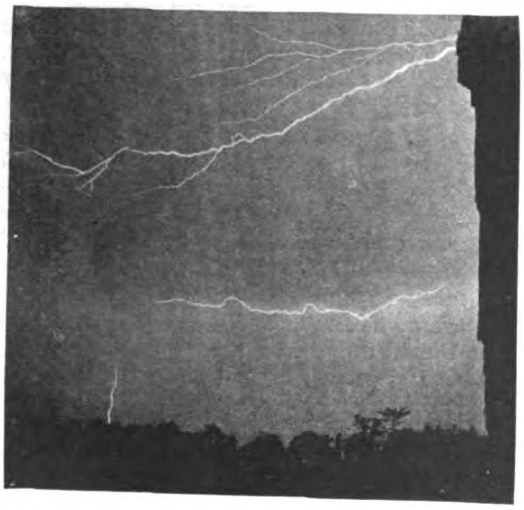
Its breadth?

Is it a solid band of light, a series of flat parallel ribbons, or merely an incandescent mass of matter flying from one point to another in space at an exceedingly rapid rate?

What causes increased thickness along the path of the discharge?

Why does not the discharge take a straight path in space?

Apropos of the fact that a heavy downpour of

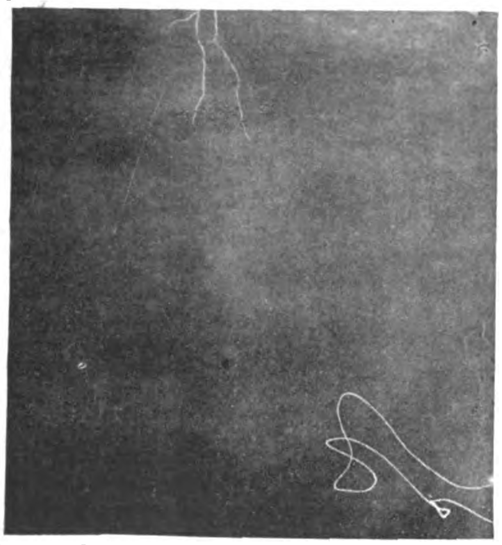


HORIZONTAL DISCHARGE, TAKEN AUGUST, 1890.

rain usually follows the discharge of lightning the experience of another observer is of interest. During a recent conversation with Prof. Samuel A. King, the well-known aeronaut, upon the subject of atmospheric electricity, he furnished a reason for this occurrence, stating that he has often observed from the car of a balloon the progress of a thunderstorm immediately beneath him. From a portion of a cloud bank covering a large portion of the heavens a band

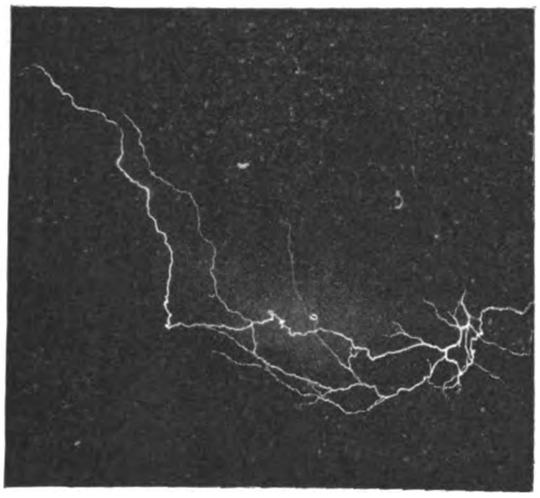
VERTICAL SINUOUS LIGHTNING, JULY, 1890.

of flame shot out in the direction of an isolated cloud some distance away, which immediately lost its cloud form and fell earthward as a volume of rain. The professor is of the opinion that as soon as the isolated cloud gives up its electricity it releases a tension which holds the molecules of matter apart and precipitation in the form of rain is the result. Perhaps, then, thunder is due to the explosion of oxygen and hydrogen forming rain, and its subsequent echo in space.



SPIRAL LOOP FORM OF LIGHTNING (VERY RARE), TAKEN JULY, 1890.

The United States Government has recently made enquiries into the subject of photo-lightning, and it is to be hoped the matter will be taken up and investigated thoroughly, as the results of the labor will certainly be of practical value in the future.



PARALLEL DISCHARGE. TWO STREAKS CONVERGING INTO ONE MAIN STEM.

The following note from Mr. Jennings forms an interesting appendix to his article.

At midnight, September 5th, last, I noticed flashes of lightning illuminating my bedroom. A camera was loaded and an excursion into the country taken, hoping to obtain a few new photographs of Jove's handiwork. The night was very foggy, and the flashes of light (very frequent and vivid) gave only blurred images of trees in the foreground. At 1:30 a. m., as I was about despairing of obtaining photographs, a sudden streak of lightning shot right through the fog, followed by a heavy peal of thunder, and in *less than thirty seconds* the fog had entirely disappeared, being precipitated by the electricity in the atmosphere.

In these rain producing days, perhaps some inventive genius will take a hint from this occurrence for the dissipation of fog on a large scale by introducing large power-driven Holtz machines on shipboard, and sending a stream of electricity into the fog laden air from various points along the rigging, thus producing a clear area in the neighborhood of the vessel. And who knows, perhaps, by an extension of the system, some day we may see a fogless London.

ORTHODOX *vs.* POPULAR.

Our esteemed contemporary, the *American Engineer*, is publishing a series of articles on electricity, the chief aim of which, as stated, "is to give those of our readers who are interested in electrical appliances an insight into the fundamental principles and development of electrical science," and justifies their publication, if justification it needs, by the statement that "technical electrical publications are now so plentiful that the youngest of them (ELECTRICITY) has been constrained to break through the fence of electrical orthodoxy and profess work a little on the 'popular' side."

We congratulate the *American Engineer* on this series of articles, but wish to disabuse it of the idea that we are trying "to break through the fence of electrical orthodoxy." We propose to be thoroughly orthodox, but at the same time to be popular. It is too often the case that in the endeavor to be popular, orthodoxy has been sacrificed. Such, however, is not our intention.

Judging from the articles on electricity referred to, we fear that in its endeavor to be popular, our contemporary is carrying the sacrifice of orthodoxy altogether too far. It certainly should be easier to harmonize orthodoxy and popularity than to harmonize "terrestrial magnetism and the magnetism of the human system," regarding which peculiar operation the author of the articles in the *American Engineer* gives some directions.

SPACE FOR THE BRITISH ELECTRICAL EXHIBIT AT THE WORLD'S FAIR.

In a recent interview Mr. James Dredge stated to a representative of ELECTRICITY, in regard to the doubtful feeling as to a good exhibit by British electrical manufacturers at the Columbian Exposition, that the exposition managers might feel assured of an electrical exhibit from England worthy of that country. Mr. Dredge has followed up this statement by filing with Director-General Davis an application for 20,000 square feet of space for the electrical display of Great Britain. This request from the accredited representative of Great Britain should certainly set at rest all doubts in regard to the extent of the exhibit to be made by British manufacturers of electrical apparatus.

PROFESSOR SILVANUS THOMPSON—CRITIC AND CRITICISED.

Engineering comments as follows: "Prof. Silvanus Thompson made some remarks, which we notice, in order to protest against them as being uncalled for. No doubt there are certain citizens of the United States guilty of bad taste in decrying everything done abroad, and claiming for their own country the merit of originating all important advances. But these people are a minority, and even if it were not so, their existence would not warrant Prof. Thompson in saying, in regard to electrical matters, that Americans think they lead the world. When he adds that we, 'our noble selves,' lead the world, he identifies himself with that happily small number of Englishmen who are given to what we call 'bragging,' and Americans call 'spread-eagleism;' but which is objectionable to the majority of electrical engineers on both sides of the Atlantic. Americans are, as a body, ever ready to acknowledge the debt they owe to European, more especially English, physicists and engineers, whilst we trust that Englishmen are equally willing to admit that Americans show energy and resource in turning the discoveries of science to actual use, and this is the reason they often outstrip us in practical showing." To these very sensible utterances the London *Electrical Review* adds the following: "No one can read Prof. Thompson's remarks without coming to the same conclusion as *Engineering*, for they were conspicuous for their want of good taste."

ARTIFICIAL RAIN-MAKING.*

BY PROF. EDWIN J. HOUSTON.

Whenever a large mass of air is cooled below the temperature of its dew point, the moisture it can no longer hold as invisible vapor, becomes visible. If the reduction of temperature be slight, the vapor appears as fog, mist or cloud; if the reduction be considerable, as rain or snow.

Much attention has been given lately to the question as to whether rain can be caused to fall at pleasure—artificial rain producers, consisting essentially of devices whereby explosions are obtained at considerable elevations, have been tried in different forms. As to the success of these attempts the testimony appears to be uncertain or contradictory.

The idea of rain-making by mid air explosions, is probably based on the belief that rains attend or follow great battles and volcanic eruptions. Volcanic eruptions may produce very heavy rainfalls, not only because the force of the eruption and the intense heat cause upward currents in the air, but also because vast quantities of water vapor escape from most volcanoes during their eruptions.

There is a fascination in witnessing man's struggle with the forces of nature; a struggle, be it understood, not made to oppose such forces, but rather to guide them. The former effort would be foolish, the latter must meet with success, if properly directed.

Do the scientific facts, as far as known to meteorology, encourage the continuance of the efforts of would-be rain-makers? Let us inquire.

It is now generally agreed that the lowering of temperature necessary for the production of rain, may be effected:

(1) By the intermingling of masses of warm and cold air.

(2) By the carrying of warm, moist air into a cold place.

In any case the cause of the rain is, briefly, the cooling of the air until it is unable to retain all the moisture held as invisible vapor, and deposits the excess as rain.

The explosion of large quantities of any high explosive in the upper regions of the atmosphere, must produce a rapid and more or less thorough mixing or stirring of the surrounding air.

A circumstance that has been lost sight of in all recent attempts at rain-making, is that they have been made regardless of the hygrometric conditions of the air. As rain is but the excess of moisture that the air is unable, when sufficiently cooled, to retain, the amount of fall will depend on the quantity of moisture in the air, as well as on the extent of the chilling action following the explosion. To attempt to produce rain by explosions in mid-air, irrespective of the quantity of moisture in the air, is to attempt to cause water to fall when practically none is present. This is not only illogical but absurd.

It may be thought that the concussions caused by mid-air explosions might result in such a general movement of the surrounding air, as to cause rain to fall over an extended area. The flash of the explosion is followed by a sudden movement of the air causing the noise of the explosion. The phenomena of lightning and thunder are somewhat similar to the effects of artificial mid-air explosions. First we have the lightning flash, and subsequently the thunder, which is a violent concussion of air. Does this concussion bring a heavier rainfall? Popularly it is believed to do so, but the general opinion of the scientific world is that the lightning flash is the effect of a rapid condensation of the aqueous vapor, *i. e.*, of a heavier rainfall, and not the cause of such a fall. That is to say the high potential of the lightning flash is due to the enormous decrease in the surfaces of the already charged raindrops compared with the surfaces of the thousands of separate drops that coalesce to form the single drops.

There is this difference between the lightning flash and the flash of an explosion, *viz:* The former occurs over a comparatively great length of path, *i. e.*, a space of small breadth and depth, but great length.

The latter occurs in a comparatively limited space, the three dimensions of which are nearly equal.

Though lightning is not a cause of rain, there can be no doubt that if rain can be artificially produced during a period in which there is much free electricity in the air, the storm will be attended by lightning and thunder. If then, there be any increase of rain due to the presence of lightning, artificial rain-making will be more likely to succeed when the potential of the air, as regards the earth or neighboring clouds, is comparatively high.

The enormous expenditure of energy required to produce a rainstorm over an extended area would appear to give but little encouragement to man's efforts in this direction. The amount of energy liberated by the greatest explosion yet effected in mid-air is but insignificant compared with the energy liberated by nature during even a slight fall of rain.

There is, however, an important consideration bearing on the probable success of rain-making by mid-air explosions that gives to such attempts a far greater probability of success than would appear to be warranted from the facts already enumerated. Pre-supposing the existence of a sufficient mass of moist air, at preferably a comparatively high difference of potential as compared with the neighboring air or the earth, a mid-air explosion might act as the determining cause of rainfall over a wide area. The balance of the energy requisite being supplied by the moist air.

There sometimes exist conditions in the air, in which it is, so to speak, in a state of very unstable equilibrium, and a slight determining cause may result in the liberation of the stored up energy, causing heavy rainfall. In such cases no reason appears why an explosion in mid-air should not be followed by rain. At the same time it is not unreasonable to suppose that the natural causes which brought about such conditions, would, in many cases, continue to act and cause rain without artificial aid.

There are, however, meteorological conditions that probably exist frequently in certain latitudes, in which heavy rains might be artificially produced by mid-air disturbances, when, without such disturbances no rainfall would occur. Should, for example, a layer of warm, moist air exist between the earth's surface and a higher layer of cold moist air, separated by a third comparatively thin layer of air, and such conditions exist as to maintain the warm and cold layers apart, then the breaking or piercing of the intermediate separating layer might permit such an up-rush of the warmer air through the opening, that the liberation of its stored up energy by the condensation of its moisture, would result in a general up-rush of the warm moist air and the consequent production of an extended area of low barometer. In other words, the artificial rupture of the separating layer would result in the formation of a true storm center and a heavy rainfall of considerable dimensions. In such cases it would appear:

(1) That mid-air explosions will be more effective than explosions on the earth's surface.

(2) That directed mid-air explosions *i. e.* explosions in which the effect of the liberated energy is to produce an upward rush of air, would be more effective than undirected, hap-hazard explosions.

If in such cases considerable difference of potential exists between the layers of air, or between the air generally and the earth, the lightning flashes would unquestionably be effective in piercing the separating layer, especially if, as would probably be the case, the general direction of the discharge were between the layers of cold and warm air.

Since it is the ascending current that causes the heaviest rainfall, mid-air explosions of such a character as to produce an upward rush of air would probably be more successful than undirected, hap-hazard explosions in mid-air. Such movements might be effected by rockets with enlarged conical heads, or any form of fire-work that would move upward.

Since success in artificial rain-making is probably dependent on meteorological conditions, both of the lower and upper layers of the atmosphere, efforts should be made to enlarge our present very limited knowledge of those conditions.

Captive balloons, containing registering electrometers, tele-thermometers tele-hygrometers, etc., might be connected by wires with recording apparatus on the earth. The cost of such aerial stations of observation would be insignificant compared with the information that would be gained. In this way the solution of the rain-making problem may be accomplished; and the general operations of the United States Weather Bureau in particular and of meteorology in general, will be materially assisted. During the general prevalence of moist, warm air, when but a slight cooling causes a general down-pour, effective rain-making might be obtained by the sudden opening of cylinders of liquefied gases, whose expansion would cause an intense chilling of the surrounding air; such cylinders could be readily opened by means of electro magnets operated from the earth.

The following general conclusions may be properly drawn concerning the artificial production of rain:

(1) That rain can never be made to fall at will by mid-air explosions on any part of the earth's surface, irrespective of the climatic conditions there existing.

(2) That during certain meteorological conditions, mid-air explosions may result in rainfall over extended areas.

(3) That the liberation of energy necessary for such rainfall is not due, except initially, to the mid-air explosions, but to the energy stored up in the moist air from which the rain is derived.

(4) That the meterological conditions which must exist for the successful action of mid-air explosions would probably in most, though not in all cases, themselves result in a natural production of rain.

(5) That a comparatively high difference of electric potential between different parts of the air, or between the air and the earth, is possibly favorable for artificial rain-making when taken in connection with other meteorological conditions.

(6) That an undirected mid-air explosion is not as likely to produce rain as an explosion in which the main tendency of the energy liberated is to cause a general up-rush of the air.

*Abstract of a paper read before the Electrical section of the Franklin Institute, Sept. 8, 1891.

THE FRANKFORT ELECTRICAL EXHIBITION.

Our special correspondent at Frankfort writes, under date of September 13, that the famous experiment of long distance transmission of power has so far been successful. He says: The transmission of power from Lauffen is running satisfactorily at present, but as there has been no rain and the atmosphere is perfectly dry, there has been no severe test of the insulation. The generating plant is now working at a pressure of about 16,000 volts, (it will be remembered that the original plans provided for a pressure of 30,000 volts), and the generators are not developing their total output.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

Work on the Exposition buildings is progressing rapidly. The women's, mines, transportation and electricity buildings are nearly ready for the "stuff" covering. When this is applied they will then assume a finished appearance.

Nearly 3,000 men have been at work on the building operations during the past week. It is the object of the contractor to get all the buildings possible under roof in order that work on them may continue through the winter.

Great Britain has officially applied for 200,000 square feet of space on which to construct a building for her exhibits. The application was made through her representatives, Sir Henry Trueman Wood and Mr. James Dredge. One-tenth of the area applied for is to be devoted to Electricity Hall.

Germany has also applied for about the same amount of space and expects to give an equal amount of room as Great Britain to her electrical exhibit.

Both these countries intend to construct separate buildings and classify their exhibits in four general departments as follows: Electricity, Machinery, Fine Arts and Manufactures. This plan departs from the classification laid down by the commissioners.

At the last meeting of the Executive Committee, the Committee on Electricity made a full report of its transactions, including the appointment of three consulting electrical experts and the adoption of a system of tunnels for conducting electric light and power wires throughout the Exposition grounds. A detailed account of these actions of the committee was given in our last issue.

A MODEL NEW YORK CITY.

On Thursday last, Mr. Allen R. Foote read before the New York Electric Club what, for the want of a better adjective, we can only term a Bellamistic paper, on "The Making of a Model New York City." Mr. Foote proposes to reconstruct New York on an electrical basis, giving everybody and everything quick transportation, providing comfortable homes for the people (with baths, steam heat, gas for cooking, electric light and electric bells), and incidentally increasing the wages of intelligent American citizens many times. All this is to cause New York to become the commercial center of the world.

Mr. Foote does not offer very clear plans for realizing this Utopian dream of a model city, nor does he provide us with an estimate of the expense, while some of the things he proposes to do in order to clear the ground for new systems of transportation, such as brushing aside real estate titles, buildings and other obstacles, will scarcely meet with the approval of some people.

Taken as a whole the paper, although it can scarcely be considered practical, is a painstaking study of the needs of a great city. It gives one an idea of what might be done in the way of making a model twentieth century center of the world, if the inhabitants of New York could "knock off" for five or ten years in order to make the necessary alterations.

ELECTRICITY TO PROPEL THE LAKE STREET "L" ROAD CARS.

From present prospects there seems to be no doubt that the cars on the elevated Lake street road, Chicago, will be propelled by electricity. At a meeting of the directors of the road, held last week, several propositions were received in regard to furnishing capital to complete the construction of the road. Among the propositions received was one that will most probably be accepted, which came from a representative of one of the largest electric companies in the country and of an equally large car manufacturer. It is understood that the proposition made by the representative of these companies was to secure the capital necessary to complete the iron work, and the companies themselves would equip the road with cars, motors and generators. With these two firms backing the enterprise there seems to be no reason why the Lake street road should not soon be completed and properly equipped with an electric system.

BOOK REVIEWS.

THE ELECTRIC MOTOR AND ITS APPLICATIONS. By T. C. Martin and Joseph Wetzler. Third Edition. With Appendix on "The Development of the Electric Motor since 1888," by Dr. Louis Bell. The W. J. Johnston Co., Lt'd, New York. Price $3.00.

The Electric Motor and its Applications, is a handsomely illustrated quarto of 278 pages, and the present edition, the third, is a reprint of a former edition, without amendment or emendation. At the time of publication of the earlier editions, the work filled a space not otherwise occupied, and was a valuable contribution to the electrical literature of the day. The criticism might be offered that the style resembles that of the newspaper man who considers it politic to praise everything and criticize nothing. With competition among the numerous manufacturers of motors as strong as it was at that time, the temptation to adopt this policy was great, and comparisons then as now more then than now would have seemed invidious, but the fact remains that the reader to whom such a work would be most valuable is left to a great extent to draw his own conclusions.

The present edition brings the history of the development of the motor down to 1888. This is justified by the publishers by the fact that this development is now a matter of history and as such should be preserved. An appendix of 31 pages by Dr. Louis Bell, following very closely the lines laid down in the body of the work, brings this history down to about the beginning of the year 1891, thus making the work as a whole a continuous record up to the present time. In this arrangement the sins of omission are more prominent than those of commission. While a short chapter was given in the second edition on alternating current motors we look in vain for any reference to them in the appendix, the reader being left under the impression that no progress has been made in this direction, whereas quite the contrary is the case. Multipolar motors, which of late have been coming into considerable prominence, are dismissed with but a single example. We could certainly wish that the appendix were more explicit on several subjects, so as to present more accurately the actual state of the art.

The work as a whole, however, is well written and attractive in style, is singularly happy in the avoidance of technicalities, and will prove a valuable addition to the library of business men and others who wish to keep generally informed, but who have neither the time nor inclination to go deeply into electrical subjects.

THE ARITHMETIC OF ELECTRICITY. By T. O'Conor Sloane, Ph. D. (Illustrated.) Norman W. Henley and Co., New York. Price $1.00.

This is a little work containing 120 pages and fifteen tables. It is an attempt to place the mathematics of electricity on the plane of simple arithmetic. The plan pursued is to give a set of empirical rules, each followed by a single illustrative example.

It seems to us the plan of the book is faulty in several particulars, chief of which is its empiricism, which a work of this sort should aim to avoid rather than to inculcate. Although Mr. Sloane starts out with the declared intention of using nothing higher than simple arithmetic in the solution of his problems, he fails to stick to his text in some instances and drops into algebra. There would be no harm in this were the book not avowedly written with the purpose of avoiding just such a step. The book begins with a series of definitions, many of which are either misleading or absolutely erroneous, continues by giving a wrong solution to some of the illustrative problems, and closes with tables so carelessly compiled as to be worthless for reference.

We consider the book totally unfit to be placed in the hands of a beginner.

TELEPHONES: THEIR CONSTRUCTION AND FITTING. By F. C. Allsop. E. & F. N. Spon, London and New York. Price $2.00.

This is an octavo containing 185 pages and 176 illustrations, and is offered to the English public in view of the approaching expiration of the telephone patents "to give practical instruction on the working and fitting up of telephones, and also such hints as will enable an intelligent fitter, with a little practice, to readily detect and remove the different faults that are liable to appear."

The book is essentially a reprint of a series of articles that appeared in the *English Mechanic*. It deals exclusively with English practice, and would be of little service to an American telephone man who has kept pace with the times in the study of his profession.

ANSWERS TO CORRESPONDENTS.

Subscribers to ELECTRICITY are invited to make use of this column whenever electrical questions of general interest arise. Where apparatus is concerned, full details should be given.

It will be the aim of ELECTRICITY to answer all legitimate queries of an electrical nature, in as clear and untechnical a manner as possible, and thus to make this column a friendly guide to those of our readers who may desire such assistance.

Inquiries should be accompanied by the full name of the writer not necessarily for publication, but for our own information; and should be addressed to the Editor of ELECTRICITY.

"In your 'Hint for Bell Hangers,' p. 56, of August 9, will you please tell me:

(1.) What is the resistance of the bell circuit?
(2.) What is the resistance of the spool B?
(3.) What is the self induction of each?
(4.) If B were wound non-inductively, would the same results be obtained?
(5.) How far from the bell should the coil B be placed?

"BETA."

(1) and (2.) The device is intended to be applied to bells as they are usually made; that is, to bells whose coils have various resistances. Experiment shows that the best results are obtained when the resistance of the inserted coil B is slightly greater than that of the bell coils.

(3.) Since we must take the bell coils as we find them, the coil B must be chosen to suit each particular case, the main point being that it shall have as high self-induction as possible, which is obtained when the core is long and of laminated iron, or better still, if it be a closed magnetic circuit. In two otherwise similar electro-magnets of the horse shoe type, with and without armatures attached to the poles, that with the armature attached will have nearly five times the self-induction of the other. The former should therefore be used.

(4.) It follows from this that if the coil B were wound non-inductively the desired result would not be obtained.

(5.) It is necessary for the best results that the resistance of the circuit through B should not differ much from that through the bell. The extra resistance given to B is for the purpose of equalizing the resistance of that circuit with the longer one through the bell. If, therefore, th

coil B be placed near the bell, the resistance of the former may be reduced, and this is considered the best arrangement.

ENGINEER, Milwaukee, Wis.: Your plan for arranging the arc lamps is correct if they are 50-volt lamps. If, as you suppose, however, they are 25-volt lamps, and the pressure on your mains is 100 volts, it would be necessary to place four lamps in series across your circuit. It is not necessary that both pairs of lamps be taken off the circuit at the same point, as represented in your sketch; they may be taken off in series of two each at any point, and as many series of two may be arranged as the capacity of your dynamo in amperes will provide for. If the lamps are nominally of 2,000-candle power, they will consume about 10 amperes of current for every two in series across the circuit.

BEATING TIME BY CABLE.

How he once "beat time," or rather apparent time, in a remarkable fashion, is told by Mr. Archibald Forbes in an article on his reminiscences of war correspondent life in *The Nineteenth Century*. It is a story of a telegraphic dispatch from the battlefield. In the early morning of the 22d of November, 1878, a British division under General Sir Samuel Browne, occupied the Afghan fortress of Ali Musjid, up in the Khyber Pass. Mr. Forbes rode back ten miles to Jumrood, where the field telegraph was, and sent the news to England in a short message bearing date 10 A. M. There is five hours difference of time between India and England, in favor of the latter; and *The Daily News*, containing this telegram, dated 10 A. M., was selling in the streets of London at 9 A. M., one hour of apparent time before it was dispatched. Its anticipation of time, however, did not end here. Owing to the five hours difference between the clocks of London and New York, the message was in time for the regular editions of the New York papers that same morning. It was thence immediately wired across the American Continent, and, owing again to the difference in time between the Atlantic Coast and the Pacific slope, the early-rising citizen of San Francisco, purchasing his morning paper at 6 A. M., was able to read the announcement of an event which actually occurred over two hours later, in apparent time, some 13,000 miles away on the other side of the globe. Puck, as Mr. Forbes says, professed himself able to put a girdle round the earth in forty minutes, but this telegram sped half round the globe in two hours less than no time at all.

CURRENT ELECTRICAL TOPICS.

The telephone has been put to many uses but it has remained for the Chicago telephone to reunite a family after a separation of twenty-five years. While carelessly looking over a telephone directory late at night one day last week, Miss Helen Wheeler happened to run across the name of W. W. Wheeler. That being the name of a brother whom she had neither seen nor heard of for many years, she determined to call up by the telephone as soon as the first opportunity presented itself. The next day she rang up 5,094 and after asking several questions found to her utter surprise, that she was really talking to her brother, who had been lost sight of by his family for over twenty-five years. The telephone has been unjustly cursed by many impatient business men, but there will be one family in this world that will always think kindly of it.

At the recent Cardiff meeting of the British Association, the chief event was the discussion on electrical nomenclature. Dr. Lodge directed special attention to the need for giving names to two units, *viz*: that of self induction and either the practical unit of magnetic line density (B) or the practical unit of line of force. After discussing various names he said "the word *henry*, however, appears to have the greatest number of supporters in England and America. It keeps green the memory of a distinguished physicist and is a word which has already come into general use."

The Electrical Congress at Frankfort which had under discussion among other things this same question of names for the new units, adjourned without coming to any decision. The names most prominently mentioned for these units were *henry* and *gauss*.

Prof. G. Forbes, in a paper read at the last meeting of the British Association, on "Electric Motors," says: "Our electric tramways are behind those of the United States: that is undoubted." The reason assigned is that in England overhead wires are not allowed. "American engineers acknowledge" he said, "that had they been restricted as we have been in this respect, electric traction would have made no more progress in America than it has in England. It is from æsthetic considerations, so called, that the overhead wire is tabooed, and we cannot help here registering our protest against this prohibition of the overhead wire on æsthetic grounds. * * * The standards which support an overhead wire are not a whit more ugly than the street lampposts; and in a people which has allowed the Charing Cross Railway bridge to mar one of the finest urban landscapes in Europe it is mere prudery to object to an electric wire."

The Tenth Annual Meeting of the American Street Railway Association will be held at the Monongahela House, Pittsburgh, Pa., on Wednesday, October 21, beginning at 10 o'clock A. M., and continuing three days

A very large attendance is looked for. Special committees will report on the following subjects: "A Perfect Electric Motor," "A Year's Progress of Cable Motive Power," "Public and State Treatment of Corporations," "The Dependent—Overhead or Underground—System of Electric Motive Power," "The Independent—Storage or Primary Battery—System of Electric Motive Power."

An exhibition of street railway supplies will be a feature of the meeting. For this purpose a double-decked excursion boat will be moored at the wharf adjoining the Monongahela House. Heavy supplies will be placed on the lower deck and the lighter material on the upper. Special entertainments and excursions are being arranged for the enjoyment of those attending the meeting and of their families, and at the conclusion of the meeting a banquet will take place. Further information regarding the meeting can be obtained from Mr. Wm. J. Richardson, Secretary of the Association, Atlantic and Third Avenues, Brooklyn, N. Y.

At the council meeting of the American Institute of Electrical Engineers held September 22, seventeen new associate members were elected.

The electric railway in Ottawa, Can., is now in operation, and in the main is giving satisfaction. No fault is found with the service on week days but a good many complaints are heard because the cars are not operated on Sunday. This is not the fault of the company. Ottawa observes Sunday most strictly, and for that reason questions the propriety of street cars on that day. A correspondent writes to the editor of ELECTRICITY that the discontinuance of the service is objectionable, for "while we may go to the opera Saturday night we may not go to church on Sunday."

FROM NEWS CENTERS.

NEW YORK.

NEW YORK, Sept. 26.—The Commission appointed by the Supreme Court to decide whether the trolley system shall be used in place of horse cars on the Coney Island and Brooklyn Railroad, from the end of the city line up Fifteenth street and along Ninth avenue to Ninth street, resumed the hearing of testimony on Thursday. The principal testimony taken was that of C. J. H. Woodbury, vice-president of the Manufacturer's Mutual Insurance Company, of Boston, who showed that owing to appliances now used there is little if any danger to life or property from the electric currents used for railway work. Eugene Britton, of the Thomson-Houston Electric Company, also testified, and stated that when the trolley lines were first put up in Boston, they met with much opposition. Now they had come into such favor that the authorities were beset by applications and delegations of citizens enthusiastic about the extension the system. Present appearances would lead to the belief that the trolley will soon be adopted throughout Brooklyn.

The various educational institutions of that city are recognizing the necessity of meeting the demand for electrical instruction and not only has the Brooklyn Institute provided a full programme for its electrical students, but the Pratt Institute is extending the scope of its valuable course of electrical instruction. The earnestness of the desire for tuition on electrical subjects is evident from the fact that the secretary of the Pratt Institute had requests for admission to the course from three times as many applicants as he could find places for.

The sensation of the week has been a lively scene that was enacted at the Brooklyn Jockey Club track yesterday. For a long time the methods by which the Western Union Telegraph Company secured information of the result of the races for the benefit of the city and out-of-town bookmakers, in spite of the extreme precautions which had been taken to prevent them, has been a mystery. This mystery ended yesterday with a somewhat startling solution. Since Monday, a well appointed barouche, driven by an imposing looking coachman, has been drawn up daily near the betting ring. The carriage contained what seemed to be a family party, consisting of two ladies, two gentlemen and a child. The coachman always sat stiffly on the box, while the other men in the party ran back and forth between the carriage and the betting ring. Suspicion having been excited, the party was first watched and then raided, and the barouche was found to be virtually a branch of the Western Union, fully equipped and in active operation. The faultlessly attired coachman was a telegraph station, and the occupants of the carriage the operators who were working with him. The batteries were concealed under the coachman's box. In his hat was a small incandescent light by which signals were flashed through an aperture to accomplices stationed at a distance, and thus the news of everything that took place on the track was instantly transmitted to the city. G. H. G.

BOSTON.

BOSTON, Sept. 24.—Over 100 extra hands have been set on at the Lynn factories of the Thomson-Houston Company this week. It looks as though before very long the company would be employing over 4,000 hands.

During the present week the Thomson-Houston International Company has shipped to Leeds, England, the two powerful generators which are to be used on the electric street railway now under construction in that city by the company.

It is stated on good authority that the Naumkeag Street Railway Company, of Salem, Mass., is contemplating the purchase of the Essex Street Railway, so as to consolidate that road with its own system. The latter cost $207,000, and is about five miles long; should the transfer be effected the Naumkeag Company will then own one of finest electric road systems in Massachusetts.

There are over 4,000 miles of electric wires stretched over the streets of Boston, and thousands of supporting poles. The aldermanic committee on wires is anxious to have them removed altogether, or at least greatly reduced. A conference has just been held at the City Hall between the aldermanic committee and representatives of the various companies owning pole lines. Briefly, the committee's position is that some system of consolidation should be brought about that will largely decrease the number of poles in Boston, and give an opportunity to all legitimate companies to do business.

The electric light station at Plymouth, Mass., is about to be enlarged. A new 250 horse power compound condensing engine will be included in the alterations.

Mr. Fiske Warren, of Waltham, Mass., has just had completed for him by the Holtzer-Cabot Electric Company, an electric dog-cart, a facsimile of the one now in use by Mr. G. Polk, Brighton, England. The motor is of the Immisch pattern, and was imported from England, as were also the batteries. The carriage will make six to eight miles an hour on almost any road, while on an exceptionally good road it is claimed that ten miles an hour can be attained. It is steered by a worm gear, carries two passengers, and is provided with a pair of reserve shafts to use in the event of the electric power giving out.

The Boston side of the new Harvard bridge spanning the Charles river between Boston and Cambridge is to be illuminated by incandescent lights.

The West End Railway Company is spending nearly $1,000,000 in reconstructing the old New England glass works in East Cambridge, and equipping it as a power station. There will be three engines installed, aggregating 4,500 h.p. Thirty boilers will also be erected and all the steam and water piping will be in duplicate.

An interesting question, involving the right of gas and electric light companies to erect and maintain poles in the streets of cities and towns of the Commonwealth, came before the Supreme Court this week. The Attorney-General instituted the proceedings at the instance of the State Board of Gas and Electric Light Commissioners against the Walworth Light and Power Company. In 1887 the legislature passed an act providing that in a city or town where an electric or gas light company existed, no other company should be allowed to erect or maintain poles without first obtaining permission from the board of aldermen or selectmen. The defendant company was chartered in 1888, and soon after put up poles and began to do business in Boston. After a time the company applied to the board of aldermen of Boston for leave to erect poles, but permission was denied and an appeal taken to the gas commissioners, who sustained the aldermen. Some of the defendant's competitors complained to the commissioners, and the latter served notice on the company that it must take down its poles. As the order has not been complied with the case was heard before Judge Morton. The defendants contend that the act requiring permission from the aldermen is unconstitutional. At the close of the hearing the Judge announced his intention of bringing the evidence before the full bench and taking its decision thereupon.

A committee recently appointed by the mayor of Haverhill, Mass., has just submitted its report on the practicability and desirability of that city establishing a municipal plant. The report shows how the city can save $10,000 per annum by establishing its own plant instead of purchasing light by contract as at present.

Last Saturday, the twelfth anniversary of the opening of the first exchange in that city, the New England Telephone and Telegraph Company opened its handsome new exchange building in Portland, Me. The new switch board will accommodate 1,500 subscribers.

The Tremont exchange in Boston is nearing completion and will be equipped with a new switchboard. The company is rapidly extending its metallic circuits in and around Boston as well as in other cities.

The Berlin Company has some fine contracts in hand for buildings of its own substantial type.

W. S. N.

SAN FRANCISCO.

SAN FRANCISCO, Sept. 21.—Judge Hawley of the Circuit Court, has just entered a decision in favor of plaintiff in the patent infringement suit of the California Electric Works against Julius Frincks. The question of damages has been referred to the Master in Chancery.

The fight among rival cable road companies and the San Francisco and San Mateo Electric Railway Co., for possession of Stanyan street, near one of the main entrances to Golden Gate Park, is going on with great vehemence before the Board of Supervisors. Scores of petitions, protests and applications have been filed with the Street Commissioners, but that body sees no way out of the dilemma without creating very bitter feelings. It has called several meetings of the representatives of the roads with a view to having them come to an amicable compromise.

The boom in things electrical across the bay continues. Scarcely a day passes but that improvements are made in the old plants or plans are conceived to introduce electricity in some form or another. Mr. C. W. Bassett is endeavoring to obtain a franchise to operate an incandescent light plant in Alameda. Recently he made the round of the business portion of the city to secure subscribers for the light in case he gets the franchise. He promises to begin work on the plant thirty days after the franchise is granted. President Mertz, of the Alameda street car line, has again announced that horse-power will be abandoned and the road operated by electricity.

A franchise has just been granted for an electric railway from Haywards to the County line. There it will connect, or rather continue to San Jose by the same company's road (the Chappellett). Articles of incorporation have been filed by the Twenty-third Avenue, Piedmont and Alameda Railroad Co. The road is known as the Hoskins motor road. The capital stock is $100,000: $20,000 have been subscribed. At present the road is one mile long.

In Berkeley the managers of the electric road are considering plans to extend the line to North Berkeley, Peralta Park and West Berkeley. The new electric lights are all ready and will be started in a few days. Many private houses have adopted the incandescent light; part of them get electricity from the new company and the others from the motor road.

Further complications have come about in the Los Angeles street roads tangle. Several days ago Attorney General Hart brought suit to prevent the Pacific Cable Railway Co. from continuing business on the ground that it is a foreign corporation. This company is a Chicago corporation and owns the Los Angeles cable system. The State law forbids corporations organized in other states from doing business here, as the stock holders escape personal liability. Now complaint is made that discrimination has been shown in this suit, as the Los Angeles Consolidated Co. (electric) is in the same boat, being an Arizona corporation. Rumor has it that the action is in the interests of the electric road. The probable effect of the suit will be to force the cable company to re-incorporate, and other foreign corporations will have to follow suit. The cable road is still in the hands of a receiver. If the cable company could be re-organized, as proposed, under the laws of California, the indebtedness would all be paid before the re-organization took place.

B.

SOME USEFUL ELECTRICAL DEVICES.

There has recently been incorporated in Pawtucket, R. I., the Electrical Specialty Company, which owns the patents of Van A. Thomas, superintendent of the Narragansett Electric Light Company's central station, Providence. These patents have been granted for certain useful devices which must come into quick and general demand. Among these devices are several which we describe below.

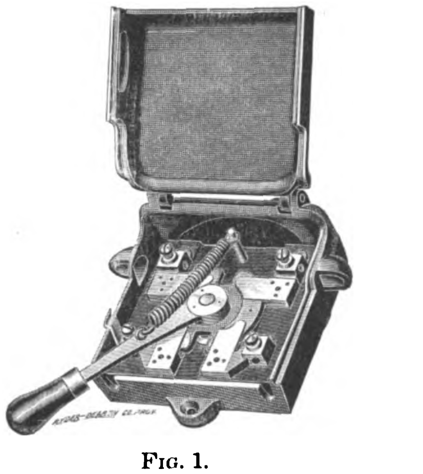


FIG. 1.

Fig. 1 represents a commercial cut-out switch, which differs from most others in use in several important particulars. The switch base itself is made wholly of iron, thus being practically indestructible; its dimensions are 6 inch x 6½-inch, being about the smallest switch made, at the same time efficiency has not been sacrificed to compactness. The construction is such that it is claimed to be impossible to form an arc, even when a circuit of fifteen or more lights is thrown on. The spiral spring causes the handle to work with great rapidity in both directions. We understand that quite a number of parent companies, as well as many central stations, now use these switches with good results.

The same company manufactures the various forms of break arms shown in Fig. 2. As will be seen from their shapes, they are a great improvement on the old-fashioned brackets. In general construction work, the arms numbered 2, 25, 7, 15, 20 in the cut, have been found particularly useful. Every style shown is well adapted for useful service, and those engaged in construction work will appreciate the value of these devices, both on the score of safety and of economy.

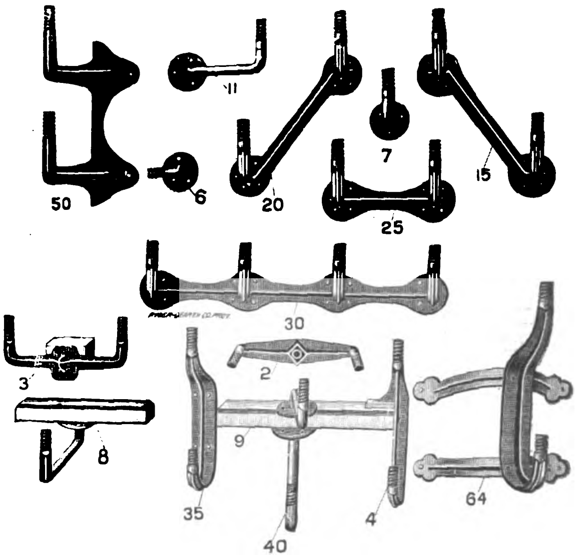


FIG. 2.

Another very useful auxiliary to a well equipped electric station, is the load transferrer, illustrated in Fig. 3. Station superintendents do not need to be reminded how often it happens that a dynamo becomes disabled, or that part of the load has been taken off, rendering it necessary to shut down a machine. The purpose of this instrument is to transfer the load from one machine to another, without allowing the lights to be even dimmed, and without the slightest danger to the operator. This device is also available for use during the night when part of the lights are shut off and the demand for current is limited. By its aid the man in charge of the dynamos regulates the out-put of current and so economizes station expenses.

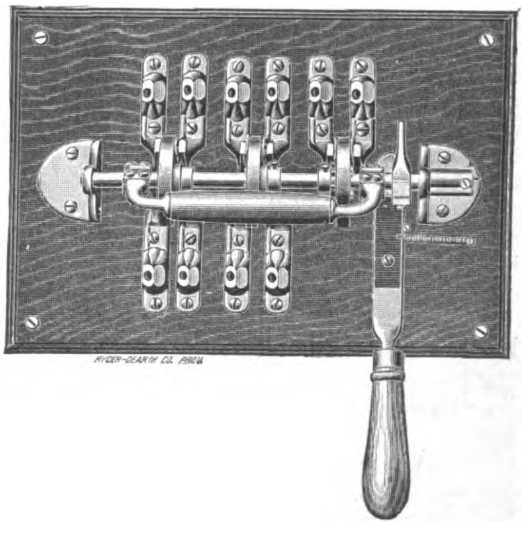


FIG. 3.

As will be seen by the illustration, the load is transferred by a movement of the lever, the cords and plugs being properly adjusted beforehand. This ingenious instrument has been in use in quite a number of stations, and it is highly spoken of by those who have had experience with it. The company also makes a mast arm which is considered a model of grace and lightness, and various other useful devices which are finding a ready sale wherever introduced. The directors and managers are men of enterprise, and with the many valuable inventions they own, they cannot fail to achieve speedy success.

The Delaware avenue line, Wilmington, Del., is said to have trebled the number of its patrons since the adoption of electricity as a motive power.

THE EDISON PRESSURE INDICATOR.

Any electrical instrument that has lived through the early years of experiment and severe tests and the subsequent remarkable development in electrical appliances, and still remains a standard piece of apparatus, must be considered of especial interest.

Of such a character is the Edison pressure indicator, which has a history extending back to the early days of electric lighting.

In 1884 engine room indicators were used in which changes in current passing through carbon filaments, caused by variations in pressure, were made to measure and indicate the change of voltage. During the past seven years various forms of indicators have been made and tried, but none have been found to equal the carbon resistance indicator in accuracy, convenience and durability, or in ability to stand a long, rough journey.

The ease with which any one who will read the directions can set up the instrument and get accurate results from it, is a good feature of the Edison indicator, and other advantages are the large movement of the pointer produced by a small change of pressure, the arrangement of scale and pointer which enables the attendant to see small variations at a distance, and the fact that the instrument contains means whereby its readings may be checked at any time; each instrument being in fact two indicators, one of which is always held in reserve to be used occasionally in calibrating the working indicator and correcting any change which may have taken place. The Edison indicator, as it stands to-day, is the result of seven years experience and experiments with all kinds of instruments, including various forms of carbon resistance indicators; and for the work for which it is designed, it is practically a perfect instrument. It is an engine room indicator and a very efficient guide and monitor to the engineer or attendant in charge of dynamos.

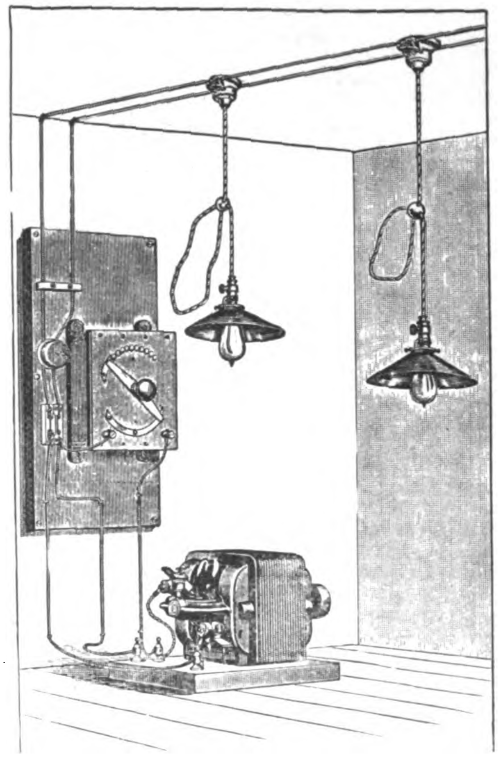
The proper operation of an incandescent electric light plant demands good regulation, the pressure must be uniform and must be kept at the normal figure or the plant will not give the best results. To maintain uniform pressure is the chief desideratum however. Lamps operated on a circuit the pressure of which is sometimes above and sometimes below normal, never give satisfaction, while lamps operated on a circuit with uniform pressure are more satisfactory, giving a better light and having a longer life, even though the pressure averages several volts higher than the normal. The best results demand not only uniform but correct pressure. Dim lamps can never be satisfactory, and lamps operated at a high pressure deteriorate and break. This is especially true regarding high efficiency lamps, so that to secure good results the resistance of a trustworthy and convenient indicator is an absolute necessity.

EDISON PRESSURE INDICATOR.

The result of the experience of the Edison Company is that the pressure indicator shown in the illustration is the best that has been produced. There is no other indicator which can be read from across an ordinary room, or which contains within itself a simple method of calibration or checking.

BAIN'S MODEL SMALL ELECTRIC LIGHT PLANT.

Inquiries are often made for a small dynamo capable of generating current for a small number of incandescent lamps. These inquiries generally come from people who have become accustomed to the use of electric light and know the value of it as an illuminant, but who have moved to localities where it is impossible for them to obtain current from a regular central station. The illustration shown on this page is a view of a small electric light outfit suitable for running a limited number of lamps. The plant includes dynamo, rheostat, switches, rosettes and lamps. The dynamo is built in six different sizes, ranging from five to fifty lights capacity, and is designed especially for lighting the offices of factories and warehouses, or private residences that are outside the area covered by the regular central station distribution. The plant is of such simple construction that it can be installed by any one having a slight acquaintance with electrical appliances, and it can be driven directly from a line shaft, or belted to an engine or turbine. The outfit is manufactured by the Bain Electric Manufacturing Co., of Chicago.



The Franklin Electric Company, 126 Liberty street, New York, is manufacturing a new style of primary battery, known as the "Ben Franklin." This battery is made in five different sizes suitable for all classes of work, from the operation of telephone and telegraph circuits up to motors and electric lighting. The officials of the company have spent eight years in experiment and research and are thoroughly conversant with all styles of primary and secondary batteries. They claim for their "Ben Franklin" cell, among other good qualities, cheapness of maintenance, low internal resistance, and freedom from polarization and local action.

Mr. Geo. C. Kuntz, formerly of the Electrical Supply and Contracting Co., of Cincinnati, and lately with the Knapp Electrical Works, of Chicago, has recently been employed as electrical engineer of the Orne Electric Construction Co., of Chicago. It is the purpose of this latter company to extend their business to general electrical construction and the installation of central station and isolated electric lighting plants.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED SEPT. 15, 1891.

DYNAMOS AND MOTORS.

459,422. Dynamo-Electric Machine and Motor. Elihu Thomson, Lynn, Mass. Application filed Oct. 31, 1891. This invention relates to a construction of field-magnet and armature cores for dynamo-electric machines or motors; and the object of the invention is to secure the advantage of directing the magnetism through field-core or through both together in such a way the line of magnetic force shall pass in a direction nearly diametrically across the armature and b subject to diversion from this course by the ci tion of currents in the wire around the armature than has hitherto been the case in such machinery

459,508. Dynamo-Electric Generator or Motor. Joh duit, St. Louis, Mo. Application filed May 25, 18 This invention has for its object the provision effective motor, operating with either alternati continuous currents with equal facility and effec wherein the induced or Foucault currents are to a degree prevented.

459,596. Mineral Drilling Machine. Elmer A. Sperry, cago, Ill. Application filed Jan. 15, 1891.

459,610. Dynamo Electric Machine. Edmond Desro Paris, France. Application filed June 17, 1887.

459,678. Electric Motor. John W. Davis and J. B. rington, New York, N. Y. Application filed May

CONDUITS, CONDUCTORS AND INSULATORS.

459,509. Conduit for Electric Wires. Henry W. Johns York, N. Y. Application filed Apr. 27, 1891.

459,525. Cable-Box for Electric Wires. John A. M Somerville, Mass., Jasper N. Keller, Newton, Application filed May 23, 1891.

459,686. Insulator. Clarence L. Gerrard, Columbus, N Application filed April 3, 1891.

LAMPS AND ACCESSORIES.

459,510. Electric Arc Lamp. Edward R. Knowles, Brooklyn, N. Y. Application filed May 25, 1891. This invention relates to improvements in electric arc lamps of the class which are universal in their application—that is to say, lamps which are practically and efficiently operative on either an arc, an incandescent or alternating current circuit, as commonly known.

459,514. Incandescent Electric Lamp Socket. John O. Phillips, New York, N. Y. Application filed Dec. 3, 1890.

ALARMS AND SIGNALS.

459,591. Electric Alarm System. John P. McMahon, Jersey City, N. J. Application filed Jan. 24, 1891.

ANNUNCIATORS.

459,615. Annunciator. Foster Ritche, Highland Park, Ill. Application filed Dec. 29, 1890.

RAILWAYS AND ACCESSORIES.

459,425. Motor Car Fender. Edward Tiemann, Chicago, Ill. Application filed Dec. 22, 1890.

459,456. Railway Danger-Alarm. Daniel J. Haynes and Orren Allen, Denver, Col. Application filed Sept. 16, 1890.

459,485. Trolley Wire Connection. Robert J. Caldwell, Rochester, N. Y. Application filed June 10, 1891.

459,588. Trolley Wheel. George E. Lewis, Seneca Falls, N. Y. Application filed Dec. 20, 1890.

459,633. Railway Signal. Henry C. Horstmann, Naperville, Ill. Application filed May 15, 1891.

459,689. Slide Shoe Trolley. Sidney H. Short, Cleveland, O. Application filed Apr. 15, 1890.

459,690. Rheostat for Electric Motor Cars. Sidney H. Short, Cleveland, O. Application filed March 18, 1891.

459,721. Safety Cut-Out for Overhead Wires. Nicholas Froloff and Wm. Subbotin, Boston, Mass. Application filed Feb. 17, 1891.

MISCELLANEOUS.

459,423. System of Electrical Distribution. Elihu Thomson, Swampscott, Mass. Application filed Dec. 19, 1890. The prime object to be secured by this invention is virtually a changed relation of the effectiveness of the two armature-windings which are inductively related to each other on the core. These armature-windings, normally, would bear a relation which would produce a certain potential in one circuit from a given potential in another circuit; but under load these relations would have to be varied somewhat and in order to compensate for the drop in potential both in the machine itself and in the mains. Thus, for example, should the windings be of equal potential or of equal effective length under certain conditions, when the conditions of load were changed these windings should become of greater or less effective length relatively one to the other, and this cannot of course be done by adding sections of wires. It must be done by adding magnetic value to one winding and not to the other or reversing a magnetic field which has been operating one direction on one of the windings.

459,442. Till-Alarm. Henry Garrett, Dallas, Texas. Application filed Nov. 12, 1890.

459,465. Electric Switch. Boyd W. Allen, Boston, Mass. Application filed Nov. 6, 1890.

459,536. Method of Manufacturing Hose. Chas. F. Simon, Bristol, R. I. Application filed Apr. 27, 1891.

459,560. Cut-Out. Frank Bryen, London, England. Application filed March 11, 1891.

459,572. Commutator Turning Device. Arthur K. Bonta, Hoboken, N. J. Application filed Oct. 16, 1890.

459,605. Electric Push. John F. Wollensak, Chicago, Ill. Application filed Jan. 28, 1891.

459,663. Apparatus for Working Punkas. Henry E. Walter, London, Eng. Application filed May 19, 1891.

459,681. Electric Belt. Christian H Dorenwend, Toronto, Canada. Application filed Sept. 16, 1891.

459,704. Electric Fixture. Edwin T. Greenfield, New York, N. Y. Application filed Dec. 31, 1890.

459,705. Electric Light Fixtures. Edwin T. Greenfield, New York, N. Y. Application filed Dec. 31, 1890.

459,706. Electric Snap Switch. Gerald W. Hart, Kansas City, Mo. Application filed June 22, 1891.

BATTERIES.

459,447. Fibrous Carbon Battery. James H. Robertson, Ruthford, N. J. Application filed Nov. 17, 1890.

459,491. Method of Making Plates for Secondary Batteries. S. C. C. Currie, Philadelphia, Pa. Application filed Jan. 24, 1891.

459,535. Secondary Battery. Wm. L. Silvey, Lima, Ohio. Application filed June 27, 1891.

459,448. Telegraph Apparatus. William E. Sloan, John E. Hughes and Orrin S. Reed, Chicago, Ill. Application filed July 5, 1890.

459,711. Fastener for Spring Jacks of Switch Boards. Charles E. Scribner, Chicago, Ill. Application filed May 7, 1891.

ELECTRICITY.

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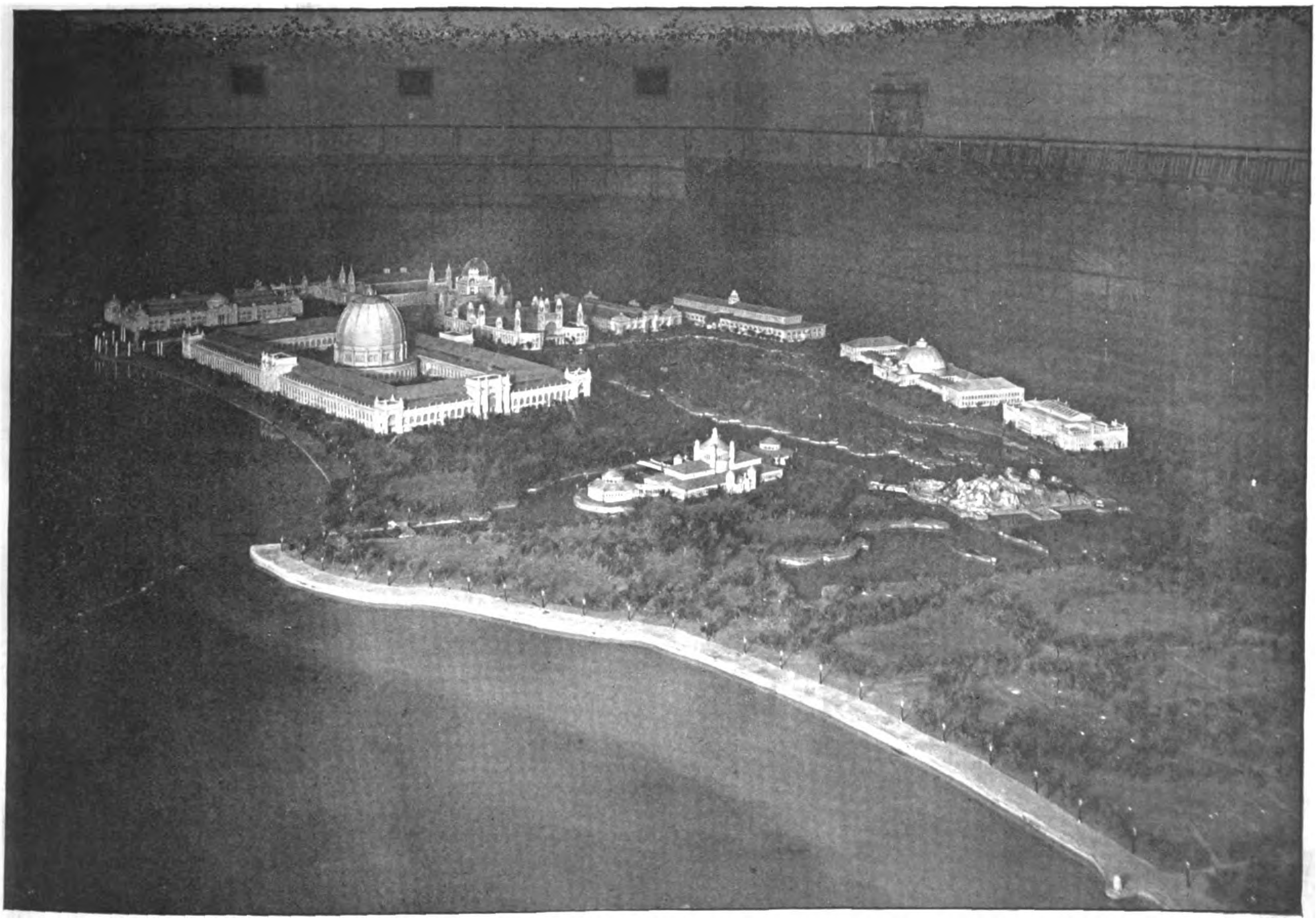


MODEL OF THE WORLD'S COLUMBIAN EXPOSITION.

(*See page 152.*)

THE MODEL OF THE WORLD'S COLUMBIAN EXPOSITION.

Our frontispiece this week represents a birdseye view of the Columbian Exposition, taken from a point northeast of Jackson Park about half a mile from shore and 1,050 feet above the surface of the lake. The engraving is reproduced from the latest and best photograph—not heretofore published—of Phillipson's World's Fair in Miniature, and gives a better idea of the arrangement of the buildings and grounds than could be obtained on the grounds themselves.

This model, the work of the Phillipson Brothers of Chicago, is claimed to be the largest and grandest of its kind ever produced and on a scale of one-eighth inch to the foot, covers a floor space of 47x92 feet, representing an actual area of 673 acres.

In the middle of the picture the large building with a dome is that of manufactures and arts, said to be the largest building in the world. It covers a ground space of 788 by 1688 ft. The engraving represents the building as originally planned—a quadrangle with interior court, but the demand for space was so great that it was decided to arch over the court, bringing the whole under one roof.

Directly in front of this building, but on the further side of the lagoon, not represented, is the site of the Government building and on this side of the canal is located the Fisheries, 163x363 feet, with circular aquaria at either end 135 feet in diameter. To the right of this in the foreground is the Wooded Island in the north end of the lagoon, and the turreted structure at the other end and to the right of the Liberal Arts is the Electrical building.

In comparison with its neighbor it looks insignificant in size and electricians have maintained from the start that it was inadequate to the purpose. Its dimensions are, however, 350 by 700 feet.

The next two buildings to the right are those of Mines and Transportation, covering respectively areas of 350 by 700 and 250 by 960 feet. The domed building on the right is Horticultural Hall 250 by 1,000 feet and that in front of it, occupying a space of 200 by 400 feet fronting on Midway plaisance, will contain the Women's exhibit.

The two large structures in the far distance are the Agricultural building on the left, 500 by 800 feet with an annex 300 by 500 feet, and Machinery Hall, 500 by 1,400 feet, the two being connected by an arcade.

To the north of the Machinery and to the south of the Electricity and Mines buildings is situated the Administration building, 225 by 225 feet, surmounted by a dome rising to a height of 300 feet, visible in the middle distance. In front of this will be placed the statue of Columbia and in a semi-circle to her left will be erected the thirteen St. Gaudens Pillars, sixty feet high, representing the thirteen original states.

The wooded territory in the immediate foreground traversed by avenues has been parcelled out to the various states for their state buildings. These are at the north end of the grounds.

Just beyond the cape on the left of the picture a breakwater will be constructed, within which will be placed the Naval Exhibit and still further in the distance to the left of the St. Gaudens columns another breakwater will be constructed, enclosing a harbor for pleasure craft, at the lake extremity of which will be located the Casino, 172 by 300 feet.

A contract has just been concluded by Edwin M. Fox, London counsel of the Sims-Edison Electric Torpedo Company, by which Sir William G. Armstrong, Mitchell & Co. begin at once the manufacture of their torpedo for Great Britain and the colonies. The first trial of the torpedo in English waters, will take place shortly at Portsmouth before the Lords of the Admiralty and many distinguished naval experts.

A CURIOUS ACCIDENT TO A 110-VOLT INCANDESCENT LAMP.

BY J. C. LINCOLN.

The lamp in question was one which had been used to connect in series with the field of a generator when cutting a machine out of circuit.

On such occasions the electro-motive force was very much above the normal for an instant, the brilliancy of the light being momentarily increased.

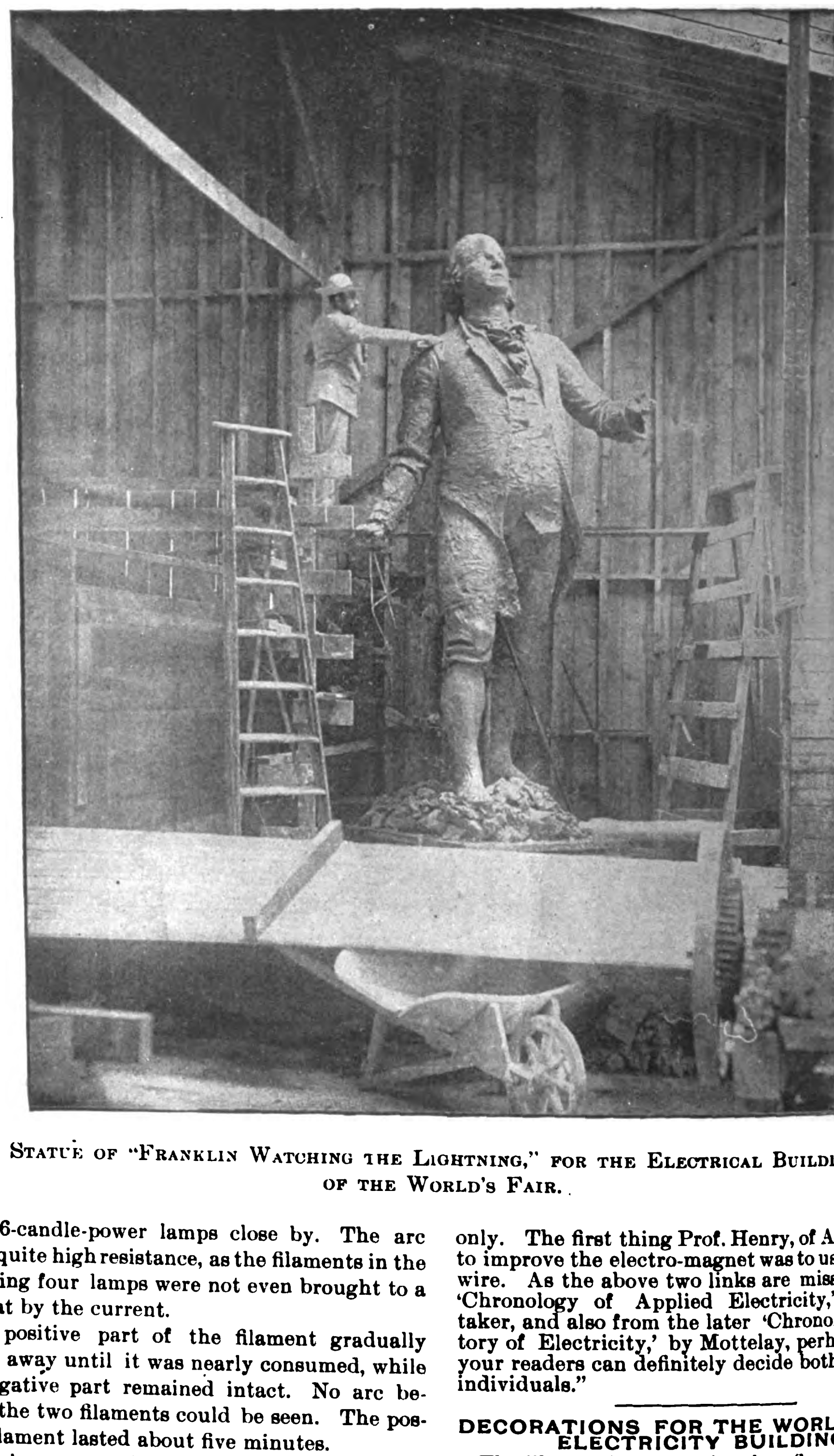
This ordeal had evidently caused a mechanical disintegration of the filament, for when the lamp was put in regular service with four others on a 500-volt circuit, it burned all right for a few minutes and then the filament broke.

An arc was now established between the two ends of the broken filament, which produced a light of between one and two hundred candle-power, as near as could be judged by comparison with 16-candle-power lamps close by. The arc of was quite high resistance, as the filaments in the remaining four lamps were not even brought to a red heat by the current.

The positive part of the filament gradually wasted away until it was nearly consumed, while the negative part remained intact. No arc between the two filaments could be seen. The positive filament lasted about five minutes.

This is an example of the production of light, which, if it could be effected in a practical way would be very economical. The light had the brilliancy and color of an arc light, and must have had its economy, while the resulting light was of comparatively small candle-power.

Does anyone know of experiments performed with small carbons on electric arcs in vacuo? Work in this direction might be rewarded by the production of a light combining the economy of the electric arc with the convenience of the incandescent lamp.



Statue of "Franklin Watching the Lightning," for the Electrical Building of the World's Fair.

WHO INVENTED MAGNETIC NEEDLES AND INSULATED WIRES?

A correspondent, who signs himself Sam Vyle, writes from Georgetown, Demerara, to the London *Electrical Review* as follows: "For some time past I have been trying to ascertain who first gave the world magnetised steel needles, and to whom belongs the honor of first insulating wire.

"So far as my limited search here will admit, Robert Norman, of London, made a specialty of supplying such needles for compasses; whilst Prof. 'Schweigger' seems to have used wire covered with cotton, or silk, for his 'Multiplier' or galvanometer, in 1822. Yet Sturgeon in 1825 did not know how to insulate wire, or he never would have wound his electro-magnets with *bare* copper, with one layer only. The first thing Prof. Henry, of America, did to improve the electro-magnet was to use insulated wire. As the above two links are missing in the 'Chronology of Applied Electricity,' in Whittaker, and also from the later 'Chronological History of Electricity,' by Mottelay, perhaps you or your readers can definitely decide both dates and individuals."

DECORATIONS FOR THE WORLD'S FAIR ELECTRICITY BUILDING.

The illustration above is taken (by permission) from our excellent contemporary, *The Graphic*. This journal, in an article on the Exposition, published last week, says: "The decorations in plaster for the electrical buildings are being modeled and some very beautiful work is shown, the most notable being a heroic size figure of 'Franklin Watching the Lightning,' by Carl Rhol Smith."

ELECTRICITY

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In strong contrast to the remarks of Prof. S. P. Thompson, which we quoted last week, is the following little sentence: "We are quite ashamed of the telephone in England." This occurs in a paper read by Mr. Preece at the Frankfort International Electrical Congress.

* * *

The illustrations which we present this week of the Frankfort Electrical Exhibition will be examined with interest by electrical firms who intend to be represented at the World's Fair. The full page picture of the wire and cable exhibit shows a very tasteful and artistic arrangement of a class of material which does not lend itself very readily to attractive display. With this hint before them, our wire manufacturers will probably be able to improve on Frankfort in 1893.

* * *

Emerson has said "Steam is half an Englishman." Whether that is so or not, it is incontrovertible that the electric motor is a sprightly young Yankee. An article in this issue, entitled "The Ideal Electric Motor" will be a revelation to all interested in the electric transmission of power. It describes some of the results attainable by the remarkable improvement in motor regulation invented by Mr. H. Ward Leonard.

* * *

The electrical engineers who are working on the plans for lighting the World's Fair buildings have a task of unequalled magnitude before them. The illumination of the Fine Arts Building, for instance, will require no less than 15,000 incandescent lamps. This will unquestionably be a larger incandescent installation than any hitherto attempted and will present a very pretty problem in distribution. The more one hears of the World's Fair, the more one is inclined to agree with Sir Henry Wood that at all points it will excel in magnitude all of the great expositions that have been held.

* * *

It seems likely that electricity is to be called in to explain many of the celestial phenomena which have hitherto been ascribed to other agencies. That wonderful yet beautifully simple instrument, the spectroscope, which has revealed to us so much of the cosmos, still seems to be baffled in some directions where difficulty would scarcely be anticipated. Strangely enough, the phenomena which it fails to satisfactorily explain are either such as are known to be electrical in character or are at least strongly suspected of so being. From this and other facts, Stas has been led to suspect that the ordinary interpretations of the spectroscope are not to be relied on when it is applied to electrical phenomena.

We give elsewhere a resumé of the present attitude of astronomy towards celestial phenomena of supposed electrical origin which cannot fail to interest all of our readers who have ever bestowed a thought on the fascinating study of solar physics.

* * *

In the columns of the London *Times* and of the English electrical journals a very active discussion is proceeding on the question of "telephoning" London at a profit with a subscription of only $50 a year. There can be little question that no large city will in future accept a telephone system which is not provided with underground metallic circuits, and the cost of underground cables would make the rate which those who are anxious to "re-telephone" London propose to charge entirely inadequate to meet the expenses and pay a profit.

New York at present has about 9,000 telephone subscribers, and the underground system comprises nearly 300 miles of 50-pair cables. These cables alone have cost about $1,000,000, exclusive of subway rentals, roof privileges and other items of expense attendant on underground work.

New York City is a much more concentrated district than London, and an underground telephone system in the latter city would probably require considerably more than 1.6 miles of double conductor per subscriber, which is about the allowance in New York at present. We think that without question the proposed scheme of providing telephone service in London at a rate of $50 is, in the present state of the art, utterly impracticable.

* * *

Rapidity and accuracy are the watchwords of modern life. Our New York correspondent in his letter this week says that efforts are to be made to secure a prompt mail service between New York and Brooklyn. At present, letters between those two cities joined together by a bridge take nearly as long in transit as letters sent from Chicago to New York. It is unfortunate that in announcing the proposed reform it has to be said that the intention is to give New York a mail service which shall rival that of London. New York ought to have had that long ago.

In the same letter the marvelously quick telegraph service between New York and London is referred to, which results in the markets of two worlds being practically on opposite sides of the street.

In another column we print a short article on telegraphy in England, where rapidity and accuracy again stand out boldly, and in our "Jottings" this week will be found a suggestive reference to pneumatic tube service. It would seem that the mail and telegraph services in America are still susceptible of improvement.

* * *

Mr. Lincoln calls attention this week to what he terms "a curious accident to a 110 volt incandescent lamp" and suggests the possibility of a commercial application of the principle involved to electric lighting. In the early days of electric lighting many attempts were made to apply the principle of small arcs in vacuo, or in inert gases, or that of arc-incandescence in ordinary air. In 1872 Lodiguine, Kosloff, Konn and Bouliguine all brought out lamps involving either one or both of these features.

Konn's lamp, which was really that of Lodiguine, is described as comprising stems of graphite or carbon enclosed in a lantern hermetically closed and filled with nitrogen or other gas not supporting combustion. As Mr. Lincoln has observed, notwithstanding that there was a perfect or nearly perfect vacuum there was a wasting of the carbons when the arc was formed. To overcome this and to keep the carbons in adjustment Konn made one of his carbons in a bent form, hinged at the bottom, with its free end normally resting on the other carbon. An electro-magnet in series with the lamp caused the separation of the carbons when the current passed. Lodiguine's lamp, imported into France by Kosloff, was an appliance working in vacuo. A later lamp by Konn—first described in 1875—also burned in vacuo and consisted of five small carbon pencils placed vertically and resting in large carbon blocks. These were so arranged that a weighted lever pressed one down into contact with a carbon block until it was burned out, and then pressed each of the others down in turn in the same manner.

But the first lamp of this kind was probably invented by Shepard in 1852 and consisted of a triangular block of carbon upon which pressed a vertical pencil of carbon, extending through a stuffing box in an exhausted glass globe. Contact between the two carbons was maintained by heavily weighting the pencil with lead, and the vacuum was continued by connecting the lamp with an air pump. None of these lamps have survived because whatever advantages they possessed were offset by great cost and complication.

A later application of the arc, but not for luminous purposes is found in the Edison municipal (series) lamp. In this a platinum conductor passing through the seal of the lamp extends up in the globe midway between the two legs of the carbon filament. To the lower end of the platinum wire is attached a fine iron wire which holds up the lever of a short circuiting device connected to the negative terminal of the lamp. In case the filament breaks, a momentary arc is formed from the latter to the platinum wire, and the current passing through the iron wire fuses it, releasing the spring and short circuiting the lamp. M. X. Wertz of New York has recently brought out an arc incandescent lamp burning in a vacuum, but with no means of feed.

Mr. Lincoln states that no arc could be seen between the two ends of the broken filament. This was probably due to the intense illumination of the filaments themselves, in comparison with which the very feeble luminosity of the arc would not be perceptible. Then, too, the small amount of vapor of carbon passing between such extremely fine wires in vacuo would render the arc even less luminous than in the ordinary arc lamp.

CELESTIAL ELECTRICITY.

That wonderful instrument, the spectroscope, which not only tells us the composition of the most distant star and nebula, but which also enables us to measure the rapidity of approach or recession of a star along the line of sight with an error of less than three-quarters of a mile per second, and which enables the astronomer at all times to study the prominences of the solar corona, is still baffled by the Aurora Borealis.

In this latter phenomenon, which is undoubtedly electrical, there is no question that portions of our atmosphere are lighted up by electric discharges, and we should expect to recognize the spectra of the gases known to be in it, but we have not yet been able to obtain similar spectra from these gases artificially.

One of the chief peculiarities of the auroral spectrum is the presence of a peculiar bright line in the green, which often appears alone and which physicists are unable to explain. The fact of its appearing alone at times would seem to indicate an origin independent of that of the other more commonly observed lines. It has recently been suggested that the auroral spectrum was due to cosmic dust, and this theory has received some confirmation from the frequent appearance of the lines of manganese, lead, thallium, iron, etc., but Liveing and Dewar have made a series of very careful experiments which seem to disprove this hypothesis. In order to obtain metallic dust in the finest possible state of subdivision they employed electrodes of the various metals and meteorites, which, by means of disruptive discharges, were caused to give up their substances in particles as small at least as those of the cosmic dust are supposed to be. This material was carried into a tube of observation by means of a current of air or other gas, and there carefully examined.

The experiments proved, however, that metallic dust, however fine, suspended in a gas, will not act like gaseous matter in becoming luminous with its characteristic spectrum in an electric discharge similar to that of the aurora.

Prof. Schuster has suggested that the principal line may be due to some very light gas which is present in too small a proportion to be detected by chemical analysis, or even by the spectroscope in the presence of the other gases near the earth, but which at the height of the auroral discharges is in a sufficiently greater relative proportion to give a spectrum. Lemstrom, indeed, states that he saw this line in the silent discharge of a Holtz machine on a mountain in Lapland.

Mr. William Huggins, F. R. S., the new president of the British Association, in reviewing the Bakerian Lecture of 1885, says that he was led to the conclusion that the corona of the sun is essentially a phenomenon similar in the cause of its formation to the tails of comets, *viz.*: that it probably consists for the most part of matter going from the sun under the action of a force, possibly electrical, and further, if such a force exist at the sun, the changes of terrestrial magnetism may be due to direct electric action as the earth moves through lines of inductive force. Prof. Schuster takes a similar view and suggests that there may be a direct electric connection between the sun and planets.

Prof. Bigelow has recently treated the coronal forms by the theory of spherical harmonics on the supposition that we see phenomena similar to those of free electricity, the rays being lines of force and the corona matter discharged from the sun, or at least arranged or controlled by these forces.

At the extremities of the streams, for some reason, the repulsive power may be lost and gravitation be brought in play, bringing at least a portion of the matter back to the sun. Zodiacal light may be due to the accumulation at great distances from the sun, in the plane of its equator, of such material.

In a recent paper, Stas maintains that electric spectra are to be regarded as distinct from those of flame, and from researches of his own, holds that the pairs of lines of the sodium spectrum other than D are produced only by disruptive discharges. As these pairs of lines are found reversed in the solar spectrum, he concludes that the sun's radiation is due mainly to electrical discharges, but this has been disproved by Diacon and Wolf, and later by Watts, and recently Liveing and Dewar have obtained the same phenomena by examining sodium vapor in hydrogen burning in oxygen, indicating that it is due not necessarily to electricity, but to extremely high temperatures.

A remarkable instance of the inversion, not of the sodium lines, but of the more actinic lines of the spectrum, is pointed out in Mr. Jenning's article in the last issue. He found that with quick plates the most brilliant flashes of lightning failed to produce an impression, but with slower plates and slow developer there was no difficulty in obtaining good results. He also points out that the sun itself produces negative results and prints the orb black instead of white. It is scarcely to be supposed that either of these two phenomena is due to a true inversion of the actinic lines, but rather to a peculiar quality of the light emanating from sources of such intense heat, which deprives the silver salts of their power of being changed by ordinary rays.

It is readily conceivable that rays of a peculiar property may precede those of ordinary light, and when they impinge upon a particularly sensitive film, render it insensitive to those of a different wave length, whereas if the film be less sensitive these precedent waves may not have time to produce the change in the silver salts before they are affected by those of ordinary actinic power.

This explanation seems the more plausible from the result of recent experiments in chromo-photography. The basic principle upon which the process is founded is the mechanical stratification of the silver salts due to the action of stationary waves of light—each particular part of the spectrum being capable of producing its own peculiar stratification, varying in thickness according to its own wave length, and thus through the phenomena of interference being able to reflect again its own light.

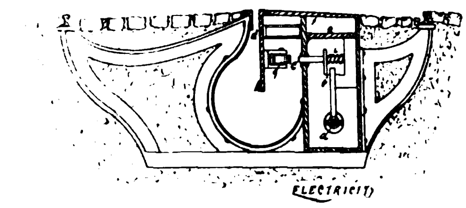
APPLEGATE'S UNDERGROUND CONDUIT SYSTEM FOR ELECTRIC RAILWAYS.

The main objection to the introduction of electric traction in large cities is the necessity of employing an overhead wire to supply the cars with current, and it is generally held that the electric car will not become popular in our large cities until either a storage battery or an underground conduit system has been successfully worked out and placed on a commercial footing. Many inventors are at work on this problem and new schemes in each direction make their appearance every now and then.

Mr. Wm. H. Applegate, of Chicago, is the inventor of an underground conduit system for electric railways in which several novel features are presented; some of them compare favorably with other conduit systems that have lately been brought before the public. Whether or not Mr. Applegate has solved the problem can only be demonstrated by exhaustive practical trials, but a description of the system will interest many of our readers.

The car receives its supply of current, not from a bare trolley wire running the whole length of the line, but from contact points placed about sixteen feet apart. These contacts and the substitute for the trolley are illustrated in Figs. 1, 2 and 3. Fig 1 is a cross section of the track and conduit showing the contact box and feeder on the right; Fig. 2 is a vertical section of the contact box, showing the connection of the feeder with the sliding contact; Fig. 3 is the contact bar attached to the car which rubs against the contacts as the car moves past the contact boxes.

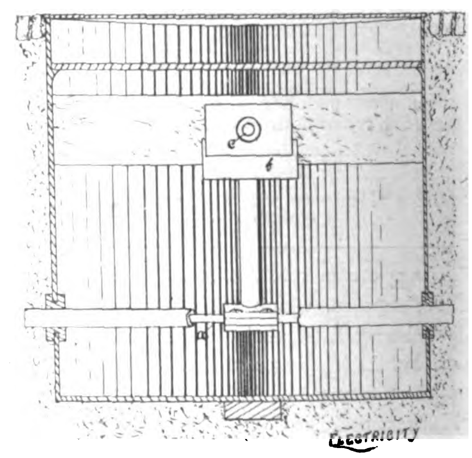
The feeder wire is an insulated, lead-covered cable, laid in a separate slate conduit. At each contact box (the boxes are of cast iron and insulated from the feeder), the insulation of the wire is removed and by means of a clamp, *a*, the wire is connected to an upright bar, *b*. Above *b* and at



Applegate's Conduit System. Fig. 1.

right angles to it, is placed a short sliding rod, *c*, provided with an arm extending down so as to overlap the upright bar *b*. In its normal position *c* is pressed outward by a spiral spring L, and the projecting arm is insulated from *b*. When the car passes in front of the contact box, the contact bar of the car (Fig. 3.) pushes *c* back and brings the arm against *b*, thus completing the connection between the car motor and the feeder through *c*, *b* and *a*.

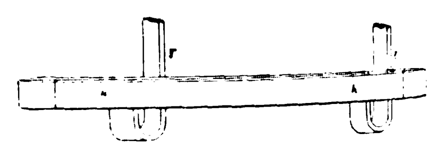
The contact bar is of such a length that it will reach from one contact point to the next and in



Applegate's Conduit System. Fig. 2.

this way maintains an uninterrupted supply of current, and avoids all sparking at the points of making and breaking the circuit. After a car has passed a contact box the spring L forces the rod *c* from the upright bar *b*, thus disconnecting *c* from the source of current until the next car passes.

The contact bar (Fig. 3) is built up of a number of layers of rubber belting, faced on one side with a strip of steel; this construction gives extreme flexibility and enables the car to turn sharp curves as well as to move in a forward or back-



Applegate's Conduit System. Fig. 3.

ward direction. The bar is supported from the axles of the car by the two curved rods, I I. The contact boxes are so arranged that all the working parts are accessible from the surface of the street, and an entire box can be removed and replaced, or any simple repair made, without interfering with the operation of the cars.

The Applegate Electric Conduit Company has been formed to exploit this system. A working model is now on exhibition at the Inter-State

Exhibition, and the company proposes to equip a short line in or near Chicago to show the merits of the system on a practical scale.

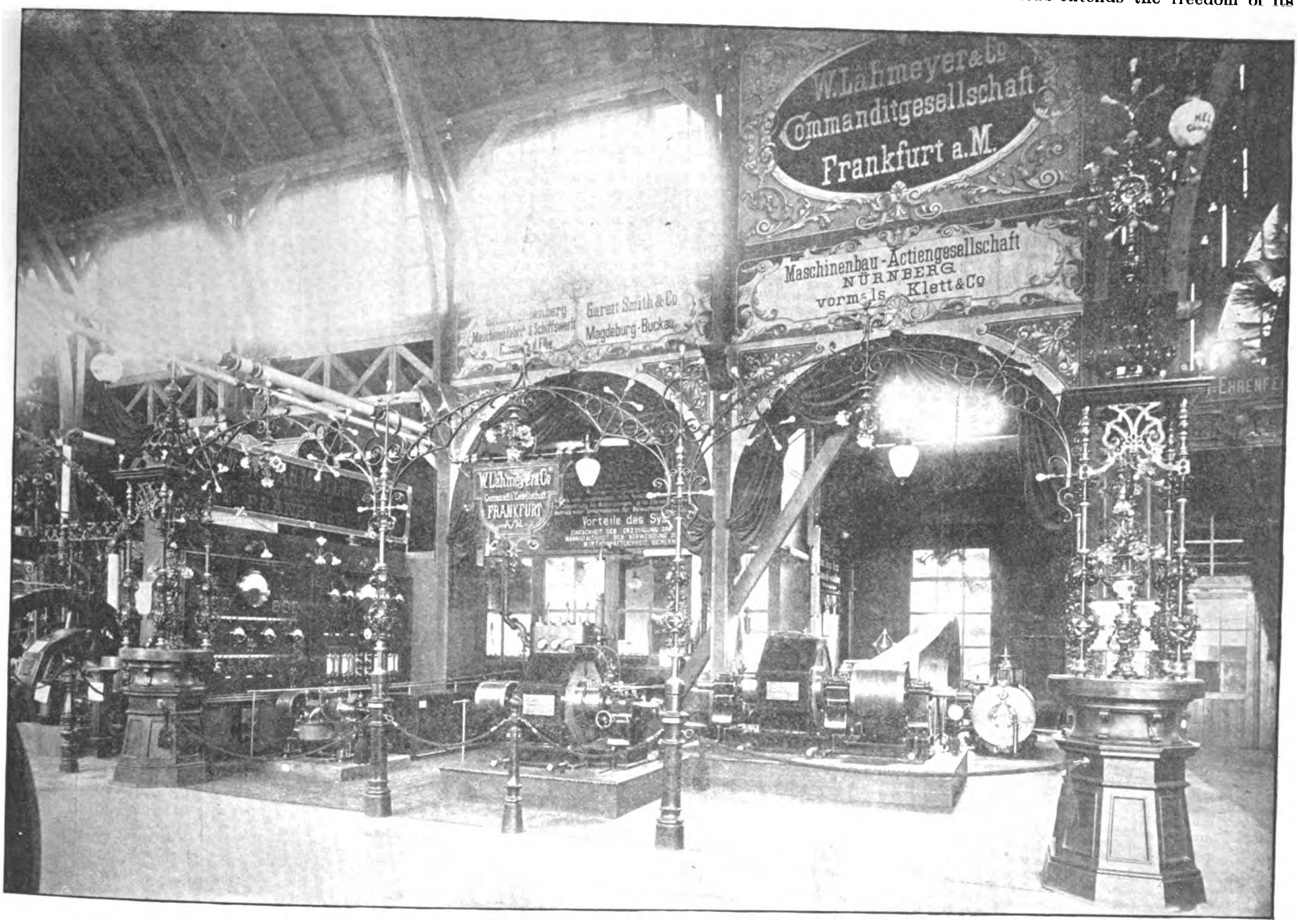
FRANKLIN AND THE ROYAL SOCIETY.

In a sketch of the Royal Society recently published by *Engineering*, the following reference to Franklin is made:

"In 1756 Franklin was elected a fellow of the society, and while he was in England he was a very active member and contributed several important memoirs. His electrical discoveries, as is well known, attracted great public attention from their practical application, and led, indirectly, to the most ridiculous, but by no means the least bitter of the quarrels from which the records of the Royal Society are no more free than are those of most other human institutions.

In 1769, a committee of the society was appointed to advise the dean and chapter of St. Paul's upon the best manner of protecting the cathedral from lightning, and under the directions of the committee, arrangements as efficient as the knowledge of the time enabled them to be, were made for the purpose. In 1772 a similar committee was appointed to report on the best means of protecting the Purfleet powder magazines. In their report they very properly recommended pointed conductors, but one member of the committee, a Mr. Wilson, dissented from this proposal and declared that all lightning conductors should be fitted with knobs on their ends.

Mr. Wilson, being a person of influence, managed to get his views taken up by the Board of Ordnance, and he was assisted by the fact that the Purfleet magazines were actually struck by lightning. No doubt this trumpery dispute would never have attracted the slightest attention, had not the discoverer of the effects of pointed conductors been Franklin. Franklin was an American, and the dispute with the American colonies was then at its height. No good patriot consequently could admit any merit to exist in a pointed lightning conductor. The question became a popular one. As in Lilliput, people became big-endians or little-endians, and for as valid a reason. George III. himself took a side, ordered the points to be taken off the royal conductors, and bade Sir John Pringle, then the president of the society, support Mr. Wilson. Sir John is credited with the dignified response, "Sir, I cannot reverse the laws and operations of nature," to which the king, naturally incensed that so incompetent a person should hold so important an office, responded, "Then, Sir John, perhaps you had better resign," which Sir John did.



View of "Machinery Hall," Frankfort Electrical Exhibition.

A NEW ELECTRO-METALLURGICAL PROCESS OF EXTRACTING COPPER FROM ITS ORES.

In the usual electrical processes of extracting or refining copper, it will be remembered that the ore undergoes some preliminary process, such as roasting for sulphate or other soluble salt, which is afterward leached and precipitated by metallic iron or electrolytically, or else smelted for black, pimple or ingot copper and then refined electrolytically by using this product as an anode in a solution of copper salt, usually sulphate.

Messrs. Siemens and Halske have recently brought out a new process which will be interesting to electro-metallurgists. They do away entirely with the copper salt solution, substituting ferric sulphate. On combining with the copper in the ore, the ferric sulphate is reduced to the ferrous state, and when the copper is deposited—which is done electrolytically—the iron salt is re-oxidized to the ferric state and thus rejuvenated.

The solution may be used over and over again, as there is no consumption or waste of material, and there is no attempt to use the ore as an anode, the extraction and deposition being conducted as two distinct operations.

THE NEW YORK TELEGRAPHER'S CLUB.

The New York Telegrapher's Club, which was organized about two years ago with only about fifty members, has grown very rapidly, and to-day has a membership of over five hundred. The object of the club is to promote sociability among the members of the craft, who number thousands in New York alone. On the second Tuesday of each month the club extends the freedom of its rooms to the wives and lady friends of the members.

During the month of October the officers of the club have arranged for a great many attractions for the members, chief among which is the lecture to be given by Mr. Marion Kerner, an old-time telegrapher who did service in the war. He will give a realistic illustration of the Passion Play at Ober-Ammergau. This lecture will take place at Chickering Hall on Sunday evening, Oct. 11.

The Detroit Electrical Works, having been delayed in supplying cars for several plants for which they had contracts in the past, have decided to materially enlarge their works by the addition of a $40,000 building. The factory will then have a frontage on Baltimore avenue of 700 feet, and the company will seek to keep a supply of its cars—the Rae system, mounted on McQuin steel trucks—constantly on hand.

TELEGRAPHY IN ENGLAND.

Mr. W. H. Preece, Electrician-in-Chief of the British Post Office, read a most interesting paper at the International Electrical Congress at Frankfort, on "The Progress of Telegraphy and Telephony in England," from which we take the following abstracts. "In 1852 the telegraph instrument in use in England was Cooke and Wheatstone's double needle. One wire (half the circuit) transmitted on the average 10 words a minute. Now, in 1891, one wire transmits 600 words a minute. Then one wire carried only half a message. Now one wire habitually transmits six different messages at one and the same time. Then messages cost twenty-five cents a word; *now* they cost *one cent* a word."

"There are four things essential to the commercial success of telegraphy:

1. Well constructed lines that shall be free from interruption.
2. Perfectly working apparatus that will develop the utmost capacity of each circuit.
3. A well-educated staff, not afraid of work and trained to habits of accuracy.
4. Rapidity of delivery of messages.

"The favorite instrument is the sounder. Messages are read by the ear and not by the eye. It is by far the most accurate instrument in use. The Morse recorder is to us a fossil, rejected for its antiquity and liability to error.

"Successful telegraphic business is dependent on accuracy and dispatch. The engineer may keep his wires in admirable order, the electrician may perfect his apparatus, the telegraphist may transmit and write down with absolute accuracy, but all the effect of this may be lost if the message is not promptly delivered. A loitering messenger is the bane of the telegraph. In England we employ boys alone for this work, and we pay them practically by results. The boy who delivers the greatest number of messages earns the highest pay.

"A message can now be sent between any two places in England and a reply received within half an hour, if the recipient of the messages resides near a post office. If this time is exceeded, it is almost invariably a delay in delivery, either because the receiver resides far away or because he is not to be found.

"The Great Central Telegraph Office affords a striking example of the increased amount of business developed by reduction in tariff and promptness in despatch; 50 per cent. of the work in the United Kingdom is transmitted through this office. The staff employed numbers 3,453, and the salaries paid amount to upwards of $1,600,000. The total number of telegrams passing through the office in 1890-91 was 32,537,779.

"The work done for the Press in England is enormous.

"5,003,409 press telegrams, containing 600,409,000 words, were delivered to the public in the year ended March 31st last, about 2,000,000 words per day."

With regard to telephony Mr. Preece had but little to say, for a reason which we note in another column. Referring to the London-Paris telephone line, which is 311.3 miles long, he said:

"There is no circuit in or out of London on which speech is more perfect. We have spoken also between London and Brussels, Lyons, and Marseilles, the latter circuit being 1,440 kilometers long.

"The charge for a conversation between London and Paris is two dollars for three minutes use of the wire. The average number of talks per day is 86. The maximum in one day has been 118. We have had as many calls as 19 per hour. 450 words have been sent and recorded in 3 minutes, which means *five words for two cents.*

MEMENTO OF GOETHE AT THE FRANKFORT ELECTRICAL EXHIBITION.

RAPID TRANSIT FOR NEW YORK.

The four engineers who were requested to prepare reports on the plans submitted by the Rapid Transit Commissioners have completed their task. The Commission has had the reports under consideration for about two months.

The two experts who submitted plans were William E. Worthen and W. Barclay Parsons. Octave Chanute, president of the American Society of Civil Engineers; John Bogart, State Engineer; Joseph M. Wilson, engineer for the Pennsylvania Railroad, and Theodore Cooper, comprised the committee that examined the designs.

Messrs. Bogart and Wilson favor Mr. Worthen's plans, which provide for a double-decked, four-track road. Under his plan no removal or interference with the pipes and conduits under Broadway would be necessary, and it would be less expensive than that of Mr. Parsons. Mr. Cooper also regards Engineer Worthen's plans with favor, while Mr. Chanute suggests a compromise system made up in part from each of the plans.

With the views of these six experts to guide them, the Commission is now working on a final report to the Board of Aldermen, which will embody practically all the features of the proposed scheme of rapid transit for the West Side.

NEWS FROM THE FRANKFORT ELECTRICAL EXHIBITION.

In one of the principal buildings of the exposition is an exhibit of the oldest preserved electrical apparatus (in working order) of the great poet and statesman, Goethe. This apparatus was used by him for demonstrating the principles of frictional electricity. It is the property of the Goethe National Museum, Weimar, Saxony, Germany. Goethe's birthday was celebrated at the Exposition and in the city of Frankfort. The following quotation was found in many prominent places and especially at this exhibit, a view of which is shown in the illustration.

"Die Electrizität ist das durch gehende allgegenwärtige Element, das alles materielle Dasein begleitet; man kann sie sich umbefangen als Weltseele denken." GOETHE.

Which may be translated as follows:

"Electricity is the penetrating and all-pervading element which accompanies every material existence, and without hesitation we may consider it the soul of the world."

The telephone system of Racine, Wis., was crippled and the 350 instruments rendered useless during a storm on Sunday last. The trouble was caused by an electric light wire falling upon the telephone wires. The wires leading into the central office were set on fire and every line was cut off from communication with central.

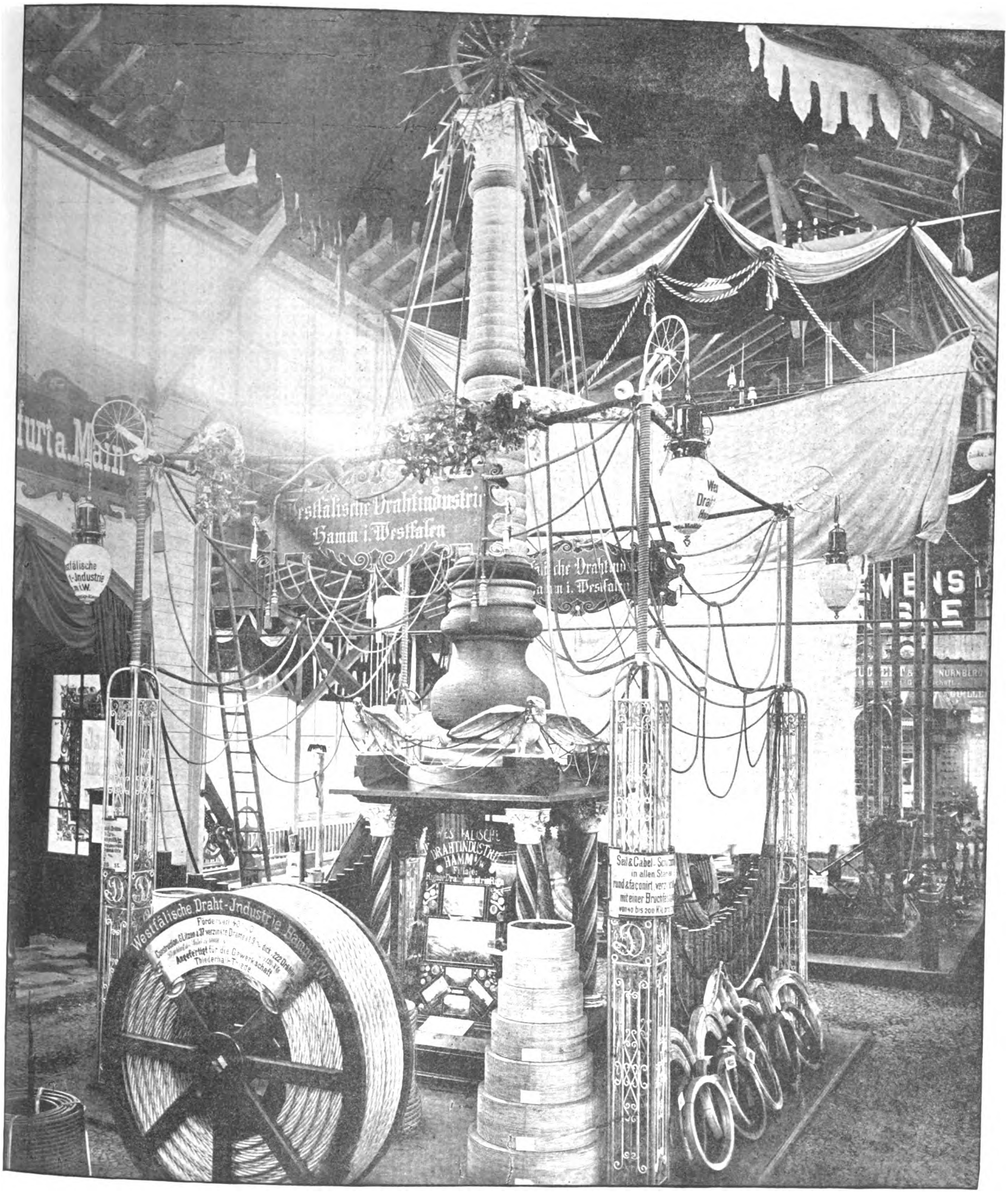


Exhibit of the Westfalen Wire Company, at the Frankfort Electrical Exhibition.

THE WIRE INDUSTRY OF HAMM, WESTFALEN, GERMANY.

The wire and cable manufactures of this company are exhibited in a very attractive and artistic manner, as shown by the accompanying photograph.

In the center is a splendid column of coils of galvanized iron and copper wire, surrounded by four Prussian eagles, each carrying an incandescent lamp. On the top of the column is placed a gilt wheel with wings, from which radiate numerous arrows, the symbol of progress, speed and electricity. The whole is surrounded by a fence of iron rods, round and square, and of all sizes, and this fence is flanked by four single columns, each surmounted by a support for an arc lamp, used for illuminating the exhibit at night.

THE BROTHERHOOD OF ELECTRICAL MECHANICS.

We have before us a neat and attractive pamphlet, entitled "Prospectus and Journal of the Brotherhood of Electrical Mechanics for 1891." This is a new organization of both educational and benevolent character, which was founded in August, 1890, in Chicago, where it now has permanent and comfortable quarters in the Fullerton Block. A lecture hall and reading room have there been fitted up and the nucleus of an electrical library has been formed.

It is the intention of the Brotherhood to establish local stations in all the principal cities and to hold a national convention as soon as twenty-five such stations have been established. In the words of the prospectus:

"Our object is to secure for ourselves that technical education, the need of which we feel in our daily work, knowing that by securing this technical knowledge we can raise the standard of excellence among our members, and thereby make ourselves more valuable, and consequently able to command better wages. We believe that '*Knowledge is Power*,' and that this is the correct solution of the labor question.

"We have also for an object the care of sick or disabled members, the burial of dead members, and the securing of positions for members who are unemployed.

"Our Brotherhood is not a labor organization in the general acceptance of the term. We leave the question of wages where we think it properly belongs, that is, between employer and employee. We are unequivocally opposed to strikes, and to anything that will interfere between employer and employees, as we believe their interests to be identical."

The declared object of the Brotherhood certainly commends itself not only to the electrical mechanic, but also to the employer. The organizers have hit upon the only true way of increasing their wage earning power, *viz.*, by making their labor more valuable to the employers. All other methods are artificial and the increase of wages obtained thereby is fictitious and can but be ephemeral.

If the plan proposed is carried out, the Brotherhood of Electrical Mechanics will avoid the rock on which the older labor organizations always have and always will split. They are sure to have both capital and the press on their side, and the good wishes of all will be with them. Electricity congratulates the founders of this new organization on the wisdom displayed in its inception, and promises to be not the least of the many who will bid them God speed and extend them a helping hand.

THE FRANKLIN EXPERIMENTAL CLUB.

This club held its first regular meeting of the season on Tuesday, Sept. 29. There was a good attendance and there is every indication of an increased interest in the society and its work. The club is preparing to move into larger quarters, and a large increase in the membership is confidently expected, as the organization has passed the crucial stage of its existence.

Those desiring further information may address the secretary, Mr. F. W. Hillard, 153 Mt. Pleasant avenue, Newark, N. J.

After the business meeting on Tuesday evening, the members were addressed by President Hammer, who spoke on the Convention and Exhibition of the National Electric Light Association, at Montreal. Prof. George C. Sonn then gave a most interesting talk on his summer tour in Europe, where he visited the electrical exhibition at Frankfort. He also described many things of scientific interest which he saw in the cities of England, France, Germany, Switzerland and Holland. His remarks were listened to with much interest. The society then adjourned, to meet Oct. 13. The meetings are held on the second and fourth Tuesdays in the month.

GARDENING BY ELECTRICITY.

In the last few years some very interesting experiments in gardening by electricity have been made by Prof. Selim Lemstrom, of the University of Helsingfors. These experiments have been carried out both upon the potted plants in the hothouse and with plants in the open field, the insulated wires in the latter case being stretched upon poles over the plot of ground and provided with a point for each square metre of area.

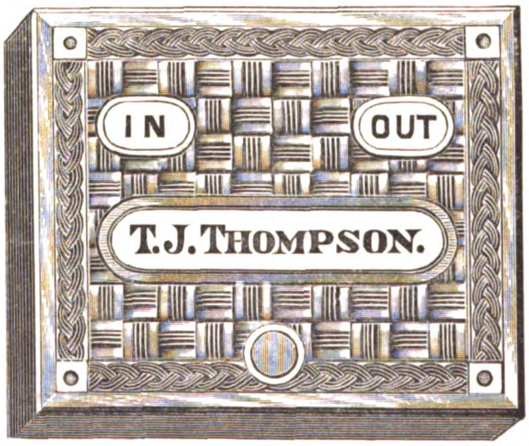
The current was supplied by Holtz machines run from 8 to 18 hours daily, the positive pole being connected with the network of wires and the negative with a zinc plate buried in the ground.

The electric influence was scarcely perceptible in the growing plants, but was very marked in the yield of many species, especially of barley and wheat, of which the crops were increased by one-half in some cases. In the hothouse the maturity of strawberries was greatly advanced.

The results have shown that plants may be divided into two groups; one the development of which is favored by electricity, comprising wheat, rye, barley, oats, red and white beets, parsnips, potatoes, celeriac, beans, raspberries, strawberries and leeks, and the other whose development is more or less interfered with by electricity, including peas, carrots, kohlrabi, rutabagas, turnips, white cabbage and tobacco.—*Irrigation Age.*

AN ELECTRICAL NAME-PLATE AND INDICATOR.

The number of three and four story apartment houses and flats is constantly increasing, and inventors have applied themselves to the object of reducing the labor and time consumed by those living in the upper stories in answering calls at the lower door. Mr. T. J. Thompson, of Chicago, has invented a novel apparatus to serve this purpose. The illustration represents a combination push button, name-plate and indicator. The apparatus is substituted for the ordinary push button in the hall. It is connected through a three-way switch to an ordinary electric bell. In normal condition the words "in" and "out" are at rest below the apertures; when the button is pressed and the occupants of the house are at home, or "in" to callers, the word "in" appears, and when they are absent, or do not wish to go to the door, the word "out" appears.



Thompson's Door Indicator.

The changes in the indicator are produced by the switch, placed in the inner room, by means of which the current is sent in one direction or the other, as the switch is turned on or off.

This ingenious and useful little device is placed on the market by the Union Electric Works, of Chicago.

ELECTRICAL CURRENT TOPICS.

"Having to inspect an arc and incandescent installation at Lille, supplied with current from a dynamo driven by a gas engine, I was able," says M. Witz, in a recent note in the *Comptes Rendus*, "to compare the quantity of gas consumed in this manner with that previously consumed by the lamps and regenerative burners employed in the illumination of the same locality. Some 16 arcs and 71 16 c.p. glow lamps replaced six powerful double regenerative Sée lamps, 91 ordinary, and 9 batswing burners. The electric lamps gave 15 per cent. more light than the gas lamps, a fact I was able to ascertain by comparative measurements of the illumination of the floor surface, and, in addition, they lit up a few places where there had not previously been any gas lamps. Now, things being so, the gas engine only consumed 752 cubic feet per hour, while the gas lamps consumed 927 cubic feet. Thus, when we employ gas as the motive power for driving a dynamo supplying current to electric lamps we consume 17 per cent. less gas than we should if we burned the gas at the burners, and we obtain much more light.

Professor Kennedy states that if steam engines are run with only a quarter of their full load, it costs about double as much in fuel and power to light an incandescent lamp as when the generating machinery is working at full load.

A Lockport correspondent writes: "A fight has been begun between local capitalists and Rochester capitalists over the building of an electric line twelve miles long between here and Olcott, on Lake Ontario. The Rochester men have filed articles of incorporation and the following officers have been elected: President, John M. Fitzgerald, of Charlotte; vice-president, E. S. Benedict, of Greece; secretary, O. F. Tiffany; treasurer, John Paine; attorney, E. W. Maurer, of Rochester. The directors are D. D. Budd, F. W. Clark, L. L. Hillman, W. H. Anderson, W. N. Button, Adam Bertch, F. Filsner and L. E. Brown, most of whom live in Rochester. The capital stock is $120,000. The local company is formed and both are trying to secure the right of way."

"We have gradually removed," says Mr. Preece, "all the difficulties due to internal and external causes that rendered long-distance speaking difficult. We have reduced telephone circuits to silence, in spite of 10,000 volts and alternating currents. Heavy copper conductors, low inductive capacity, metallic circuits, aud twisted wires, have eliminated all inductive troubles."

One of the most forcible tributes to the genius of American electricians that we have heard of was paid by the head of one of the most prominent electric lighting companies in the United States by refusing to fill an order for more of a certain staple article than would last two months. The reason he gave was that in that period the whole system of incandescent lighting might be completely revolutionized.

BIDS ON AN ELECTRIC LIGHT PLANT WANTED.

Mr. Chas. G. Armstrong, consulting electrical engineer, informs us that the Insane Hospital at Centerville, Indiana, requires a complete steam and electric plant to have a capacity of 3,000 incandescent lamps and 20 arcs. The plans and specifications can be seen at Mr. Armstrong's office, 1302 Auditorium Building, Chicago, where bids will be received up to October 8.

Mr. Armstrong will also shortly invite bids on a central station plant for Carthage, Ill., the specifications for which are being prepared. He has just started a central station at Monticello, Ill., having a capacity of 750 incandescent lamps and 25 arcs.

THE ELECTRIC LIGHT IN CHICAGO.

When the system now known as the "Chicago" style of architecture was first introduced, it was argued that the construction of buildings with sixteen and seventeen stories would admit of a better distribution of natural light and therefore would not require much artificial illumination. The argument may have been true, but observation shows that better provisions are made for artificially lighting the high office buildings than in any of the smaller ones. With these provisions and the number of structures now being added to the already formidable list, the electric lighting business, although reported poor in other parts of the country, bids fair to be exceedingly good in Chicago during the Fall and Winter months.

Of the large buildings that are nearly completed or in the course of erection the Masonic Temple takes the lead in the number of lights required for its illumination. The total number of lamps called for is over 7,000. This structure is the first eighteen story building erected in Chicago and when complet ed will be one of best electrically equipped office buildings in the city. Current is to be supplied by six Thomson-Houston dynamos.

The Fair building is probably next in importance, electrically considered, of the high office structures now being erected. This structure will be seventeen stories high and will be supplied with an isolated plant of both arc and incandescent lamps. The upper eight stories will be devoted exclusively to offices. These will be lighted by four thousand incandescent lamps. The lower nine floors will be used as a retail store and will be lighted by one thousand arc and a number of incandescent lamps. When completed this will be the largest and best lighted retail store in the world.

Electricity is to play a prominent part in the lighting of the new Ashland building that is being erected on the site of the old Ashland Block at the corner of Clark and Randolph streets. The building will be used exclusively for offices, and will have 3,650 incandescent lamps. The building will have its own electrical plant, which will contain three sixty-kilowatt dynamos.

The Woman's Temple will contain something out of the regular line of electric lighting. The fixtures and brackets will be of very handsome designs of a much more ornate character than usually adopted in down town buildings. The generating plant is to consist of three six-hundred-ampere, Western Electric Co. dynamos, and will furnish current for 3,600 lights. The dynamos are to be belted to a countershaft driven by two large Corliss engines. The Northern Hotel is to be lighted with 4,500 lamps; current will be supplied from the Edison Company's central station. The Monadnock building, which is directly opposite, on the corner of Dearborn and Jackson streets, will be supplied from the same source. This building will contain 4,100 lights. Among the many other tall office buildings that are being wired for electric light are the Cook County Abstract building with 1,500, the Unity and the Athletic Association buildings with 2,000 lights each. The Leiter building, recently rented for a retail department store, will be lighted by 200 arc lamps and 1,000 incandescent. The new *Herald* building, although not classed among the sky scrapers, is worthy of mention as it is to be one of the best lighted newspaper buildings in the country. Specifications for the electric lighting plant call for 50 arc lamps and 1,840 incandescent. Fourteen of the arc lamps will be arranged on the front and flagstaff of the building.

Numerous changes have been introduced in many of the new buildings. It has been the custom for architects to allow from sixty to seventy square feet to each 16 candle power lamp, this has been reduced to thirty and forty square feet, in most of the new structures. Interior conduits are being used to a considerable extent for carrying the electric light wires, where concealed work is required. Another noticeable feature is the substitution of electric light fixtures in place of the old style combination fixture. The tendency is to place gas jets in wall brackets only. This goes to prove that people are gradually being educated to believe that electricity can be depended upon to give continuous service.

At the present time there are in course of erection fourteen structures, varying from sixteen to twenty stories, that are to be lighted by electricity. This does not include the endless number of hotel and apartment houses that will also use electricity as an illuminant. The erection of this large number of buildings has created a boom among construction companies and will call for over a half a million lamps, besides accessories, to be supplied by the manufacturers.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

After spending a couple of weeks looking over the grounds of the Columbian Exposition and selecting a site for the exhibits of their respective countries, the foreign commissioners, Mr. James Dredge and Sir Henry Wood, representing Great Britain, and Herr von Wermuth, Commissioner from Germany, left Chicago this week, very enthusiastic over the prospects of the Exposition. At a banquet given the commissioners the night before they left, each said that his country would make a display worthy of the exposition and of themselves.

Plans for lighting the galleries of the Art Buildings have just been completed. 15,000 incandescent lights are to be used in the illumination of the different departments. The plan determined upon for lighting the art galleries of the exposition is undoubtedly the most extensive system of illumination by electric light yet attempted in a single structure.

Eighty-five men were at work on the Electricity Building last week. The flooring is being put down on the foundations and from now on it will be pushed to completion.

It is expected that after next Thursday the temporary electric light plant will be in operation. The small frame building in which it has been installed has been completed. After that time the contractors will have light enough to enable them to employ night gangs on the buildings.

Arrangements have nearly been completed with a number of exhibitors at the Frankfort Electrical Exposition to ship their displays directly to Chicago. Orders have been sent to the Eastern headquarters that alien laborers, mechanics or experts in the employ of foreign exhibitors, and coming to the United States in connection with foreign exhibits at the exposition, will be freely admitted and subjected to no delay or hindrance of any nature. The information will be sent to all foreign governments.

Leopold Sonnemen, President of the Frankfort Electrical Exposition, and one of the foremost citizens of South Germany, who was for years a member of the Reichstag, is an enthusiastic champion of the Chicago exposition. He is the proprietor of the *Frankfurter Zeitung*, one of the most influential journals in Germany. Through his newspaper Mr. Sonnemen is earnestly advocating an active and extensive participation by the German people in the exposition.

The Movable Sidewalk Company have erected, at the north end of the exposition grounds, an experimental track upon which to test their system. It is expected that a trial will be made by the first of next month, and if successful, the company will immediately proceed with the construction of a track around the grounds.

INTERIOR CONDUITS FOR BUILDINGS.

In these days a building should never be and seldom is erected without provision for the electric light. The expense of this provision is much less when undertaken before the plastering and woodwork are completed and the work can be much more thoroughly done then than later.

It is usual and preferable in all such cases to have the wires concealed, but they should be at the same time accessible, so as to permit of repairs or the substitution of larger sizes in case they are required. This desideratum has led to the introduction of interior conduits, consisting of tubes of insulating material built into the walls and ceilings, through which the electric conductors may be drawn when needed.

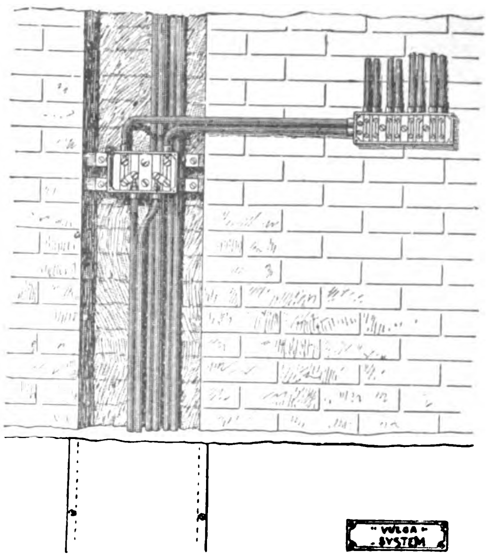


Fig. I.

Such conduits, to meet the requirements of the fire underwriters, should be strong and not liable to injury from the workmen's tools, moisture and alkali proof, so as not to be affected by the fresh plaster in which they are buried, and should have high insulating qualities, and remain hard and rigid at all temperatures. Another feature of importance from a point of view not electrical, is that they shall be composed of a material that will not stain the walls in which they are placed.

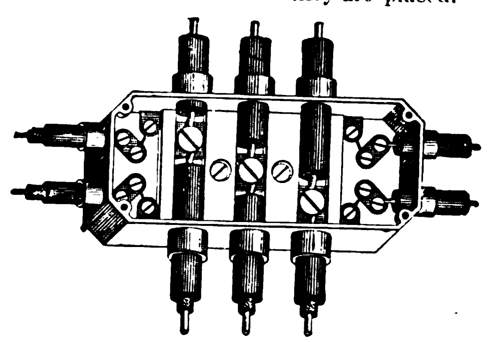


Fig. II.

A system possessing all these requisites, known as the "Vulca," and exploited by the New York Insulated Wire Company, is illustrated in the accompanying cuts. Fig. I shows their arrangement of main feeder conduits with floor cut-out and distributing box. Fig. II represents on a large, scale a type of their main line cut-out and junction box with provision for branch circuits, and Fig. III shows their straight-away cut-out and fishing box.

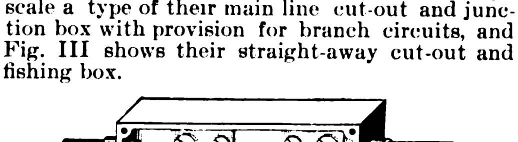


Fig. III.

With this system it is not necessary to introduce the wires until they are required, thus avoiding the possibility of damage to circuits by the carelessness of workmen and the necessity of cutting the plastering to remedy the fault after the building is completed. The interior surfaces of these tubes being hard and smooth, and the connecting curves of long radius, the conductors are readily introduced or withdrawn at any time through the fishing boxes placed at convenient intervals.

THE IDEAL ELECTRIC MOTOR.

A new system of running motors has been devised by Mr. H. Ward Leonard, which promises to revolutionize the methods hitherto adopted in this branch of electrical industry. The new system makes it possible to operate automatically at an infinite number of different speeds, perfect efficiency being obtained at any speed.

The best steam motors of to-day are able to operate at a fixed automatic speed when the load varies, but the governor arrangement maintains that speed constant. But the electric motor, on the other hand, can be operated by the new method at any desired speed, and it will still be automatic. It is also possible to operate with a constant pull, and the speed will automatically vary according to the requirements of the work to be performed.

A third possibility will be to take a certain amount of power represented by a certain speed and pull and convert it so that its pull will automatically become sufficient to move the load and the speed will automatically become such that the total energy required will be constant, entirely independent of the load moved.

One of the most important applications of the principle will be to railway propulsion. It will be possible to start a train exerting the full pull and yet with a consumption of power which will be extremely small, as the starting speed will of course be low. The speed will gradually be accelerated in a perfectly smooth manner, the power required increasing as the speed is increased. The pull can be maintained absolutely constant and the acceleration will be perfectly gradual, just as in the case of the force of gravity, and the gradual increase in the speed of the train from dead rest to full speed will be entirely imperceptible to those in the train. The slowing down in the speed of the train will be similarly accomplished in a gradual manner, and no uneven motion will be perceptible to the passengers.

Another very important application of this principle will be to the working of elevators. To-day elevators are almost necessarily restricted in their use to office buildings and places of business, as they entail the use of a steam plant which cannot be used directly, but must act indirectly through water power. This apparatus is expensive, complicated and comparatively inefficient. By the application of the new motor the motion of the elevator will be controlled from the car in the most simple manner, and the elevator can be operated with perfect smoothness at any speed in either direction. It will also be possible to control the motion of the elevator from any floor, so that in a private residence an attendant for the elevator will be entirely unnecessary, as any person desiring to use the elevator can bring it to the proper landing and then control it from within the car. The safety appliances for the elevator in conjunction with this motor are peculiarly simple and efficient. The motion of the elevator, both at the top and the bottom of the shaft, will be automatically controlled, so that an accident will be impossible so long as the device is operated; and in case of the total stoppage of the supply of current to the motor, the elevator will immediately be automatically locked and the car rendered immovable except at the will of the operator.

This system will also be applicable to printing presses, as by its adoption the press can be run at different speeds under varying loads. It will also have a wide field of application in the operation of pumps. The well known shock at both ends of the stroke in a pump whenever there is any lost motion, will be entirely eliminated, as the motion of the piston will be perfectly uniform and automatic, without regard to the amount of load. So that the relieving of the load at the end of the stroke will not cause the sudden increase of speed and jar in taking up the column of water which is apparent in the use of the steam pump.

It will also be possible to take any prime motor moved at a variable rate of speed, and transform its energy so that it can be delivered at a constant rate. This will admit of extensive application in the lighting of country residences by power derived from a windmill. In a similar manner the lighting of railway trains can be effected by taking power from the axle, regardless of the speed at which the train is moving. The problem of starting alternating current motors will also be solved, and thus the only drawback to the commercial use of this motor to-day will be overcome.

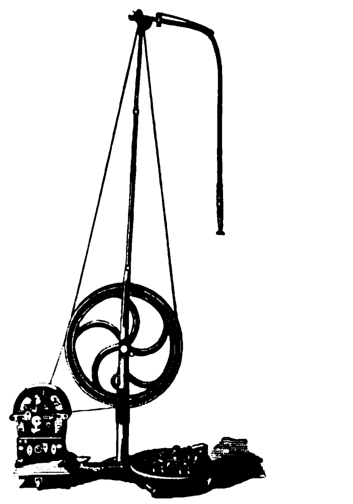
Another use for this principle of operating motors will be in rolling mills where enormous powers are required to operate at different automatic speeds under varying loads. Since all the machinery in the world to-day is designed for, and must necesssrily conform to, a single automatic speed, it is likely that a great many important uses of this motor in the operation of various kinds of machinery will develop, although at present they are not immediately apparent.

On board ship there are numerous machines in connection with which such a motor as that indicated by Mr. Leonard can be used to advantage. The steering gear, for instance, can be absolutely and instantaneously controlled by this method from the pilot house. It will also find very extensive use on men-of-war, in the handling of guns and the moving of heavy masses, as such operations can be controlled with the utmost delicacy and accuracy.

With any motor heretofore available, in order to get a sufficient pull to move a heavy load, the power has to be exerted in such a manner that as soon as the inertia of the load is overcome, the speed of the moving load will increase and the load will be moved beyond the point desired, or might be stopped before the point desired had been reached. Since the new method gives a maximum pull with a minimum speed and also instantaneous control, it will be possible to move heavy loads with the utmost ease and nicety. This, according to Mr. Leonard, is the first mechanical motive power which has been produced which can be made to give results absolutely identical with those obtained by gravity. The torque (*i. e.* pull) can be made constant and the speed gradually accelerated or retarded.

THE EDISON ELECTRIC DENTAL DRILL.

The applications of the small electric motor are almost innumerable. Another is added to the already long list in the Edison motor and dental drill. The illustration gives a good idea of the arrangement. An ordinary dental drill is used, the foot lever and crank being removed. To the old pivot is attached a strip of steel upon which a 1-12 h. p. Edison motor is mounted. The motor can be clamped in any position on the steel plate so that the driving belt can be kept at any desired tension. The motor occupies one of the legs of the stand supporting the drill and the other two legs are used to carry the reversing and resistance switch. The handle of the switch is so arranged that the operator can use it as readily as the treadle. It projects over the edge of the resistance coil, and the operator, by a slight movement of his foot, can switch it over to either side, reversing the motor at will. When the switch handle is in the central position the current is off. By moving the handle the motor is started, full speed being attained when the handle is over as far as it will go on either side.



The Edison Electric Dental Drill.

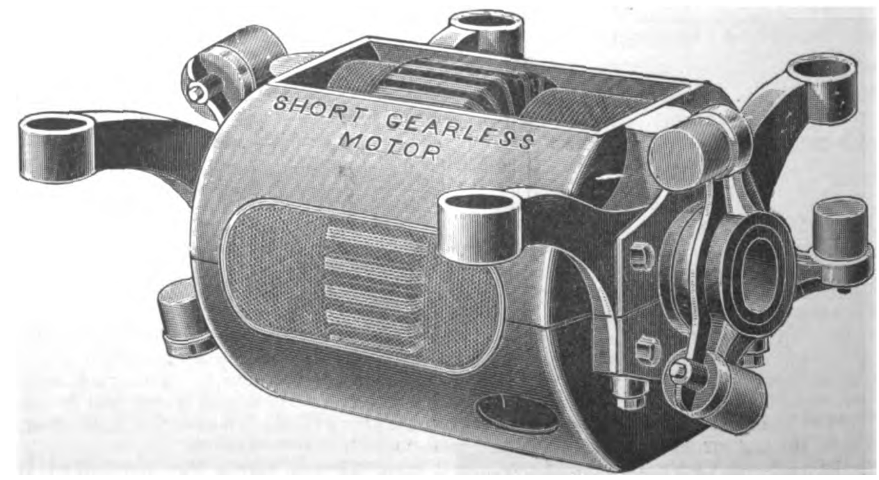
Catch clips are arranged so that the operator can tell immediately he has reached either the "off" position, or the full "on" position on either side. He can also obtain four different speeds below full speed. The motor is designed to run on a 125 volt circuit, so that it can be used on a local electric light circuit. A wall socket is fixed near the dental chair and a flexible cord led from this to two terminals on the motor. Motors wound to be operated by a battery have been perfected, so that this device is placed within the reach of the entire dental profession.

The great value to the operator of an electric motor to supply the necessary motive power is that it obviates the jar to the hand when the foot is working the crank. It also insures better and safer work, as it enables the dentist to concentrate his whole attention upon the work before him.

THE SHORT GEARLESS MOTOR.

One of the difficulties met in the problem of gearless and slow speed motors has been to obtain sufficient torque at the time when it is most needed, *viz.*, when starting from rest with a full load.

It is clear that, other things being equal, the torque will be proportional to the diameter of the armature. It will also be increased if the fields be multiplied, and the more successful attempts in this line, as exemplified in the Short gearless motor, have involved both of these features, an armature of large diameter and a multipolar field.



Short Gearless Motor.

The chief objection to large armatures, espe-

cially in street car equipments where compactness is a prime essential is, that the usual radial arrangement of the fields is not permissible.

As is well known, the Short motor has an armature of the Pacinotti type and a multipolar field with side presentation. By this arrangement no greater vertical space is occupied than that necessary for the armature alone, and a multipolar motor with armature of maximum diameter can be employed. Another feature of the Short motor is the method of connecting the shaft with the wheels. A three-armed spider is is placed on each end of the hollow shaft, each arm being provided at the extremity with a socket to receive a rubber cushion or spring. These cushions bear on lugs cast on the car wheels and as the armature shaft and spider revolve, the action is gradually imparted to the car wheels, the springs or cushions taking up and preventing the sudden shock and consumption of power usually involved in starting.

The accompanying illustration shows the general appearance of the Short gearless motor as now made and applied in street car construction.

LITERARY NOTES.

The *Engineering Magazine* is a capital number this month, even for this progressive publication. Aërial navigation, the Keeley motor and tornadoes are among the subjects discussed by well known writers. Mr. H. Ward Leonard offers a "Solution of the Block Signal System;" and Mr. N. G. Wall contributes an interesting and well illustrated article on "The New Art, Decorative Electricity."

The *Century* for October contains a most suggestive article on flying machines by Mr. Hiram Maxim, who describes in detail the progress he has made towards solving the problem of what the French call "Aviation."

The October *Cosmopolitan* has an article by Mr. William A. Eddy on "Some Great Storms." The illustrations add much to the interest of the article; some of the photographs of lightning resemble certain of those published in the last issue of Electricity.

The supplement to *Harper's Weekly* for October 3, contains an interesting and instructive article by Mr. Herbert Laws Webb, on "The Telephone in New York." The numerous illustrations which accompany the article are by Mr. H. Dearborn Gardiner, whose artistic work is familiar to readers of Electricity.

FROM NEWS CENTERS.

NEW YORK.

New York, Oct. 1, 1891.—By many signs it is apparent that New York is about to enter upon a season of almost unprecedented commercial activity, and the electrical firms of the city are looking for their full share of the promised prosperity. One of the most significant of these indications is contained in the speech of President Smith, of the Chamber of Commerce, who, in his opening address at the meeting of the Board today, expressed his belief that the labors of the Chamber of Commerce would involve, within the next six months, "the largest business that the city has ever known." President Smith continued: "When we separated for the summer a cloud of uncertainty and distrust hung over the business world. Thanks to a kind Providence that cloud has been dissipated by the gathering in of the most bountiful harvest this country has ever known."

Among other questions with which the interest of the city are intimately connected, the Board considered the organizing of better postal facilities, and passed resolutions having in view a postal system which will rival that of London. The heavy mail vans, and other lumbering methods heretofore in vogue, are likely to be superseded by a schedule which will permit of a letter being posted in any part of this city or Brooklyn and received in any other portion within one hour, so that in two hours it will be possible for the sender to receive an answer. This, considering the distressing slowness with which the most imperatively needed reforms usually progress in this city, is a very cheering piece of news.

An important case is set down for trial to-day before the Supreme Court in Washington. The case is brought by the Government of the United States against the Southern Pacific Railroad Company, the Southern Pacific Company, the Atlantic and Pacific Railroad Company, and the Western Union Telegraph Company. The purpose of the suit is to break the monopoly now possessed by the Western Union Company in the telegraph franchises through the country traversed by the railroad lines involved, and the instigators of the proceedings on the part of the Government were the instigators of the legislation under which the suit is brought, namely, the old Baltimore and Ohio Telegraph Company and Postal Union. The theory of the Government case is, that the grants to the railroads were made by Congress as much for the purpose of having telegraph lines maintained for the public benefit as for having rail transportation facilities; and hence that the railroad companies exceeded their powers when they made leases transferring control of their wires to any other corporation. So far as can at present be seen, the only effect of the prosecution, if successful, will be the annulling of the contracts whereby the railroad companies have bound themselves not to take any commercial business for the public, but to confine themselves strictly to the telegraph business incidental to the running of their roads. In any case, the decision of the question of jurisdiction is regarded as of the highest importance.

It is not generally known that on an average about 800 messages are sent daily from New York to London between the hours of 10 and 12. Although half an hour is considered a fair allowance for the delivery of a message within the city, messages are sent to London and replied to within four minutes. The result of this wonderful service is that the New York and London markets are brought so close together that either city feels the slightest fluctuation in the markets of the other almost instantaneously.

The unpleasant subject of electrical executions has again cropped up in the report of the official witnesses of the quadruple execution by electricity at Sing Sing on July 7, which was delivered last night to Superintendent Lathrop. Drs. Carlos Macdonald of New York and S. B. Ward, of Albany, to whom the task of drawing up the report was entrusted, conclude that life was shocked out of the criminals without producing any abnormal change in the organs and general structure of the body. They recommend that in future the current to which condemned criminals are subjected shall be kept on for from fifty to sixty seconds.

BOSTON.

Boston, Oct. 3.—A firm of New York engineers has this week purchased the West Haven Horse Railway and the Winchester Avenue Railway. Both systems are located in New Haven, Conn. The deal is in the interest of a syndicate of eastern capitalists, which recently purchased the street railways of Detroit, Mich., for $7,000,000. The New Haven roads are both very profitable systems and will be immediately equipped electrically.

The Eastern Electric Supply Co., of this city, has just sold two of its electric snow plows to the Lynn Belt Line Railway Co., also four snow plows to another eastern railway company. These machines were designed by Mr. Wallis, of the Eastern Electric Supply Co., and gave satisfaction where used last winter. The Eastern Electric Supply Co. has leased a suite of rooms in the Rookery Building, Chicago, where it will carry a full line of samples. Mr. W. J. Pilicy will be in charge as western manager.

At a meeting of stockholders of the Clinton, Mass., Street Railway Co. on Sept 24, it was decided to make the capital stock $30,000. A large amount of the stock was at once subscribed for. The building of the road will begin at once, and electricity will be the motive power.

The Edison Illuminating Co. begin operations this week on its newly acquired property, the old Liverpool Wharf, on Atlantic avenue. Another central station—making three in Boston—will be erected to supply the constantly increasing demand for light and power in that section of the city. The two other stations on Head Place and Hawkins street are taxed to their utmost capacity and yet cannot meet the demands for current.

A syndicate of Boston, Taunton and Fall River capitalists has been looking over the district extending from Taunton, Mass., to Fall River, via Dighton, North Dighton, Weir, Somerset and Pottersville, with a view to constructing an electric railway. They are more than satisfied with the outlook and it is expected that the project will be pushed forthwith. The track will extend along the shore road, and trains will be run often enough to meet all demands for both freight and passenger accommodations.

The manner in which the West End Railway Co. has gone to work extending its electric system throughout the central part of the city is pleasing everyone, the outlook being for a much improved service before winter sets in.

The Whitney Electrical Instrument Co. has completed negotiations with the Hon. C. H. Amsden, owner of the fine water power at Penacook, N. H., for erecting a new factory at that place to be run by water power. A three story factory will be built, and two turbines will be installed to begin with. The Whitney company was recently formed for exploiting the electrical inventions of Mr. E. R. Whitney and Dr. A. H. Hoyt.

The Simplex Electrical Co., of this city, is now shipping over sixty miles of rubber covered wire of various sizes of its own special type for use in the colossal twenty-story Masonic Temple, Chicago.

The Willimantic, Conn., Gas Co., now owns the local electric light plant and will soon build a central station of sufficient capacity to accommodate both plants.

The Thomson-Houston Electric Co. has just completed for the Okonite Co., to be used at its works, Passaic, N. J., a new transformer for testing insulation.

On Tuesday evening the citizens of Peabody, Mass., voted 225 to 10 in favor of establishing an electric light plant and appropriated $47,000 for the purpose. Work will begin at once and 120 arc lights will be installed.

An electric plant of 1,300 light capacity is about to be installed in the Bigelow carpet factories at Clinton, Mass., by the Wright Electrical Engineering Co., of this city.

Several of the daily papers in Boston are installing electric motors of very large capacity for running their presses, electric power having been found to be much more convenient in a printing establishment than steam.

The Merrimac Valley Railway, at Lawrence, Mass., which was opened a week or so ago after being equipped with the Rae system of electric traction, is reaping the reward of enterprise. On two days last week over 35,000 passengers were carried. Messrs. Shaw and Ferguson, of Boston, equipped the road, which is a fine piece of electrical engineering work throughout. The Newburyport Car Co. supplied the cars, which are of the most modern type. W. H. K.

JOTTINGS.

The question of the introduction of the system of transmitting mail by means of pneumatic tubes in some of the large cities, is one which the Postmaster-General still has under careful consideration, although the prospect of a practical test is not bright. If it were not for the great expense of introducing the system, the experiment would be tried at once in New York, Brooklyn and Chicago, but engineers who have investigated the subject, estimate that a system of tubing, even for experimental purposes, would cost between $1,000,000 and $1,500,000, and that an effective system embracing all the important branch stations in New York and Brooklyn could not be constructed at a less cost than $5,000,000. It is feared the project will have to be abandoned on account of the expense. The only way in which the great cities can secure the advantages of the pneumatic tube service in the near future is by private enterprise or by urging upon Congress a special appropriation large enough for the purpose.

In contrast to this unenterprising attitude of the Post-office Department, we note that the British Postoffice has pneumatic tubes in London, Manchester, Liverpool, Birmingham, Glasgow, Dublin, Newcastle and Bradford. There are 141 tubes in all, with an aggregate length of over 48 miles; the power developed by the engines required to work the tubes, is upwards of 520 I. H. P.

Captain Wilson, R. N., of the torpedo instruction ship, *Vernon*, has invented an appliance for cutting through the torpedo nets with which modern war ships protect themselves from torpedo attacks. The experiments already made prove to the fullest extent the tremendous power of the new invention, which has fully realized all its originator claimed for it. The inventor of the torpedo net ridiculed the idea of any instrument being able to cut through his tough, steel wire netting. But the trial just made has proved the emptiness of his boast. The great momentum of the Whitehead torpedo, armed with Capt. Wilson's new torpedo cutters, enabled it to cut its way through any torpedo net, even when the latter was set at an angle of 45 degrees, without apparent retardation of its flight. The cutter consists of blades arranged scissor-fashion, which sever the wire meshes of the net, making an aperture sufficient for the entrance of the torpedo. If this invention be adopted by the navy it cannot fail to bring about a new scheme of naval warfare.

"The electric headlight for locomotives throws a brilliant glare a long distance ahead, but it is said to be extremely trying to the eyes of engineers. Merely as an interesting experiment," says the Chicago *Tribune*, "let the railway managers try the effect of a brilliant light on the eyes of passengers inside their cars." Certainly, and let the brilliant light be supplied by electricity.

In the suit of Wm. Hood against the Perkins Lamp Company, damages amounting to over $2,000, have been awarded the plaintiff for commissions on the sale of lamps under his contract with the company.

ELECTRIC HEATING.

Among the many interesting and instructive exhibits at the recent Montreal convention, one which attracted particular attention was that of the Burton Electric Heater Company. Many street railway managers have been quick to see the advantages of this method of heating, such as economy of space, time and money, and its merits are well understood by them. The exhibition of the heaters in actual operation on an incandescent light circuit awakened interest among the central station men, who were quick to appreciate a new application for current favorable to their own business interests.

We hear that there will be a complete exhibit of the heaters at the Street Railway Convention in Pittsburgh, and also that Dr. W. Leigh Burton, the inventor, will be present at the convention, which will certainly add largely to the interest of the exhibit. This will be an occasion for street railway men to personally examine the heaters and to determine the comparative value and economy of electric and other heaters. Electric heating as electric lighting, is of universal interest, and having already been successfully employed on electric cars, the system must necessarily excite the attention of all street railway men.

COMMERCIAL PARAGRAPHS.

The Great Western Electric Supply Co. have installed a number of series sets of the Sun arc lamp in various railroads throughout the West, and in every case the lamps are giving excellent satisfaction. The lamps are operated either 5, 6 or 7 in series on a 500 volt railroad circuit, and give a beautiful white light, without flickering. The same company has just completed the delivery of the steel poles for the Citizens Street Ry. Co., Indianapolis, Ind. The poles are considered an ornament to the streets through which the lines pass. They also report large sales of K. K. wire in the central and western districts. Among them are sales to The Citizens St. Railway Co., of Indianapolis, Ind., Des Moines Street Railway Co., Des Moines, Ia., The Eau Claire Street Ry. Co., Eau Claire, Wis., and the Des Moines Water Power Co., Ia.

The Chicago Electrical Mfg. Co., 73 Jackson st., Chicago, have secured the services of Mr. J. S. Harding as superintendent of their shop. Mr. Harding has had long experience as an electrical instrument maker. After learning his trade in England he came to this country and has since been engaged with several of the largest electrical instrument companies in the country. The Electrical Manufacturing Co. are now in a better position to serve their customers than ever.

The Electric Merchandise Company report for the past week closing of contracts for the complete equipment of new electric roads in Defiance, Ohio, and Negaunee, Mich. They also report orders for Burton Electric Heaters from Amsterdam, N. Y., West Superior, Wis., Escanaba, Mich., Defiance, Ohio, Dallas, Texas, Milwaukee, Wis., Newton, Mass., Champaign, Ill., Helena, Mont., and Pullman, Ill.

Mr. C. E. Lee, who has charge of the Electric Gas Lighting Company's western agency, at 20 Lakeside Building, Chicago, has quite an extensive acquaintance among the electrical trade, having been in business for himself in Rochester, N. Y. He was also recently connected with the Great Western Electric Supply Company, of Chicago.

The National Electric Manufacturing Company, of Eau Claire, Wis., has just completed the installation of incandescent plants at the following points: Standbury, Mo., 1,000 lights; New Albany, Ind., 750 lights; Audubon, Iowa, 750 lights. All these plants have 16 c. p. lamps.

The Inter-State Exposition in Chicago, which opened last week, makes a very fair showing in the different departments of trade. In the Mechanical department a number of Chicago houses are represented, and there are also several electrical exhibits. The Thomson-Houston Electric System is used for lighting the building.

George Cutter has lately received a large consignment of Revere rubber goods. He reports a very good trade in his new Electric Tape. This is made of a pure rubber stock and is said to make a fine joint without the use of heat.

ELECTRICAL PATENT RECORD.

Letters Patent Issued Sept. 22, 1891.

LAMPS AND ACCESSORIES.

458,749. Guard for Incandescent Lamps. Harry E. Hipwell, Allegheny, Pa. Application filed Oct. 20, 1890.

459,757. Electric Arc Lamp. Maurice S. Logan, Otterville, and James H. Berley, Sedalia, Mo. Application filed Jan. 19, 1891.
Th object of this invention is to furnish an electric arc lamp provided with an improved carbon-holding rod having a clutch or other suitable feed mechanism engaging with the oblique surface or surfaces of said rod, whereby a steady uniform feed movement is attained.

459,835. Manufacture of Incandescent Electric Lamps. Thomas A. Edison, Menlo Park, N. J. Application filed Jan. 22, 1883.
Claim 1 reads:
The method of obtaining a dry nitrogen atmosphere at a definite pressure in the inclosing globe of an incandescent electric lamp, consisting in decomposing the air, retaining the nitrogen left in the globe, removing the oxygen by putting a receptacle containing the substance having affinity for oxygen into communication with the globe, and removing the moisture from the nitrogen.

459,845. Carbon-Clamp for Arc Lights. Van A. Thomas, Providence, R. I. Application filed Dec. 27, 1890.

459,846. Attachment for Electric Arc Lamps. Van A. Thomas, Providence, R. I. Application filed Jan. 8, 1891.
This invention has relation to electric lights, but more especially to the glass of arc lamps, or rather to the power portion of the lamps, adapted to arc lighting; and it consists essentially of an insulating hood or shield arranged to be readily attached to and inclose the lower or exposed metallic portion of the lamp.

459,872. Electric Lamp. Donati Tommasi, Paris, France. Application filed Jan. 14, 1891.

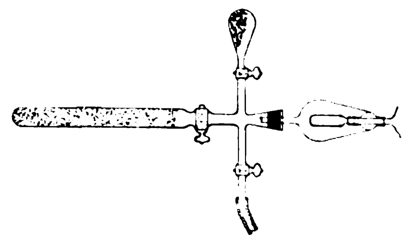
DYNAMOS AND MOTORS.

459,772. Electro-Magnetic Motor. Nikola Tesla, New York, N. Y. Application filed April 6, 1889.
Claims 1 and 2 read as follows:
1. An alternating current, non-synchronizing electric motor coupled with a synchronizing alternating current motor, substantially as set forth, whereby the former starts the latter and throws it into synchronism with its actuating current, and switch mechanism for directing the current through either or both of the motors, as set forth.
2. The combination of two motors the armatures of which are mounted upon the same shaft, one of said motors being an alternating current torque motor, or one in which the magnetic points or poles are progressively shifted by the action of the energizing current, the other motor being an alternating-current, synchronizing motor, and switch mechanism for directing the current through either or both of said motors, as set forth.

459,810. Governor for Dynamos. Mahlon S. Conly, Chicago, Ill. Application filed Dec. 23, 1890.
The prime object of this invention is to have a governor capable of use in connection with any dynamo-electric machine.

459,811. Governor for Dynamos. Mahlon S. Conly, Chicago, Ill. Application filed August 25, 1890.

459,923. Armature for Dynamo-Electric Machines and Motors. John Beattie, Jr., Fall River, Mass. Application filed Dec. 9, 1890.
The object of this invention is to improve the construction of what is known as the "Pacinotti" type of armature. This armature consists of a ring or cylinder having deep grooves in its periphery parallel to its axis, which form projections or teeth in the core of the armature. The coils or conductors are deposited in the grooves and the whole wound transversely with iron wire, the several coils of which are insulated from each other.



459,835. Manufacture of Incandescent Lamps.

460,046. Method of an Apparatus for Converting the Electrical Energy of Alternating Currents into Mechanical Motion. Charles S. Bradley, Avon, N. Y. Application filed Nov. 8, 1890.
This invention relates to the conversion of electrical energy and consists in the method of and apparatus for converting electrical energy of an alternating current into mechanical motion by raising the amount of effective counter electro-motor force developed by rotation relatively to the self-induction.
It also consists in the method of and apparatus for making such conversion by developing a phase of counter-current during the passage through the motor of less than a corresponding phase of the line-current.
It also consists of an alternating current system provided with a generator for delivering currents of a determined frequency of reversal and a motor so organized that when operated at its working speed under the influence of such current the armature will cut the fields of force developed by the field magnets oftener in a definite interval than a number of reversals of current developed on line by the generator during such interval.

460,071. Electrical Transmission of Power. Rudolph M. Hunter, Philadelphia, Pa. Application filed Nov. 24, 1890.
The object of this invention is to carry out a method, by the employment of suitable apparatus, whereby the conversion of current by means of induction apparatus may be accomplished in a more satisfactory manner, particularly when very high potential currents are to be transmitted.

469,076. Controlling Switch for Electric Motors. Schuyler S. Wheeler, New York, N. Y. Application filed Sept. 13, 1890.

460,087. Electric Motor. Ernst M. G. Hewett, Boston, Mass. Application filed April 2, 1891.

TELEGRAPH TELEPHONES.

459,930. Duplex Telegraphy. John J. Gregan, Jersey City, N. J. Application filed March 24, 1891.

RAILWAYS AND APPLIANCES.

459,737 Electric Railway Conductor Support. Edward M. Bentley, New Nork, N. Y. Application filed Sept. 5, 1887.
Claim 3 reads:
In an electric railway, the combination, of a supply conductor with hangers therefor, provided with grooved fins for receiving the wire, and metal sleeves or clips passing around the wire and holding it in place, as set forth.

459,755. Trolley Line Circuit-Breaker. Robert M. Jones, Salt Lake City, Utah. Application filed April 16, 1891.

459,794. Rheostat for Electro-Motor Cars. Sidney H. Short, Cleveland, Ohio. Application filed March 17, 1891.
This invention relates more particularly to the adjustable rheostats or rheostatic-current regulators used on electrically-propelled cars or vehicles.

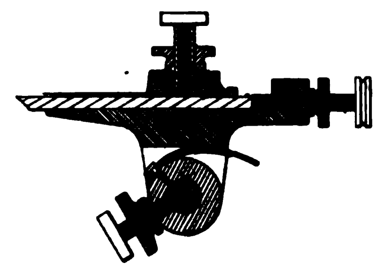
459,815. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed March 16, 1888.
The object of this invention is to provide a suitable construction adapted to suspended or overhead conductors for electric railways.

459,839. Automatic Disconnector for Overhead Conductors. Andrew L. Johnston, Richmond, Va. Application filed Jan. 19, 1891.

459,840. Automatic Disconnector for Overhead Conductors. Andrew L. Johnston, Richmond, Va. Application filed Jan. 19, 1891.
The object of this invention is to provide a device adapted to the overhead trolley wires used in connection with electric cars, and it is especially arranged for that system of electric propulsion in which the trolley wires have relays of electricity located and supplied at suitable intervals throughout its length.

459,848. Trolley Wheel for Electric Railways. Jean A. Wetmore, Brooklyn, N. Y. Application filed Feb. 4, 1891.

460,040. Motor Mechanism for Electric Cars. Sidney H. Short, Cleveland, Ohio. Application filed Nov. 1, 1890.
This invention relates to an electrically-propelled car or vehicle in which the armature of a propelling motor is connected directly with a driving wheel or axle, by direct connection being understood one which imparts a revolution to the driving wheel or axle to each revolution of the armature.



459,739. Brush Holder.

CONDUCTORS AND INSULATORS.

459,843. Insulator. Van A. Thomas, Providence R. I. Application filed Nov. 22, 1890.

459,941. Electric Cable. David Brooks, Jr., Philadelphia, Pa. Application filed Jan. 14, 1891.
Claim 1 reads:
A cable having the sections of its covering connected by strips of tin foil and rubber, the same forming a flexible connection.

460,048. Electric Coupling. Frank M. Farwell, Minneapolis, Minn. Application filed Jan. 27, 1891.

460,056. Process of Manufacturing a Composition Applicable for Electrical Insulating Purposes, etc. Ernst Fahrig, London, Eng. Application filed July 18, 1890,

MISCELLANEOUS.

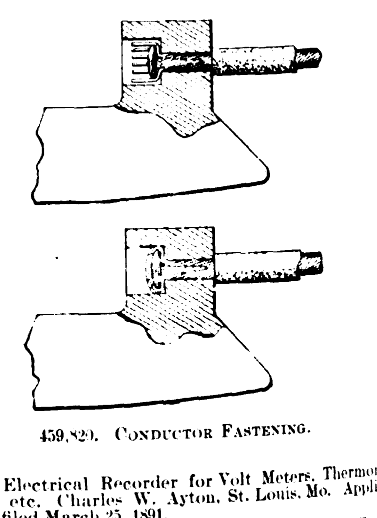
459,739. Commutator Brush Holder. Harry H. Blades, Detroit, Mich. Application filed June 12, 1890.

459,786. Electro-Magnetic Device. George R Lean, Boston, Mass. Application filed April 11, 1891.
This invention has for its object to construct an electro-magnetic device for restoring a circuit to its normal condition after it has remained in its abnormal condition a certain length of time.

459,800. Rheostat. Henry E. Waite, New York, N. Y. Application filed Dec. 23, 1890.

459,820. Conductor Fastening for Commutators. Sidney H. Short, Cleveland, Ohio. Application filed May 26, 1891.

459,852. Electro-Therapeutic Bath. Charles P. Hoffman, Utica, N. Y.; Willard B. Van Houton, Belleville, N. J. Application filed March 16, 1891.



459,820. Conductor Fastening.

459,863. Electrical Recorder for Volt Meters, Thermometers, etc. Charles W. Ayton, St. Louis, Mo. Application filed March 25, 1891.

459,917. Contact for Electric Programme Clocks. Frank E. Smith, San Jose, Cal. Application filed Feb. 21, 1891.

459,984. Burglar Alarm. Homer T. Wilson, Harrodsburg, Ky. Application filed Feb. 3, 1891.

460,019. Electric Show Case Alarm. Rudolph C. Kruschke, Duluth, Minn. Application filed Dec. 1, 1890.
The object of this invention is to provide a simple and effective electrical alarm for attachment to show cases, for detecting the absence of an article from the tray of the show case.

460,059. Electric Regulator. James F. McElroy, Albany, N. Y. Application filed Feb. 11, 1891.

460,081. Automatic Electro-Pneumatic Tube System. William G. Collins, New York, N. Y. Application filed Nov. 7, 1889.

460,095. Combination Fittings for Gas and Electric Lights. Olaf Strom, Brooklyn, N. Y. Application filed Dec. 27, 1890.

ELECTRICITY.

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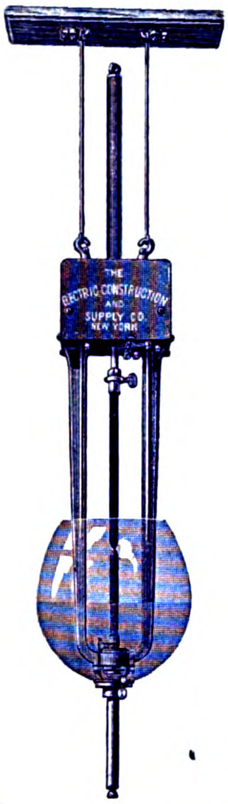

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Yours respectfully,
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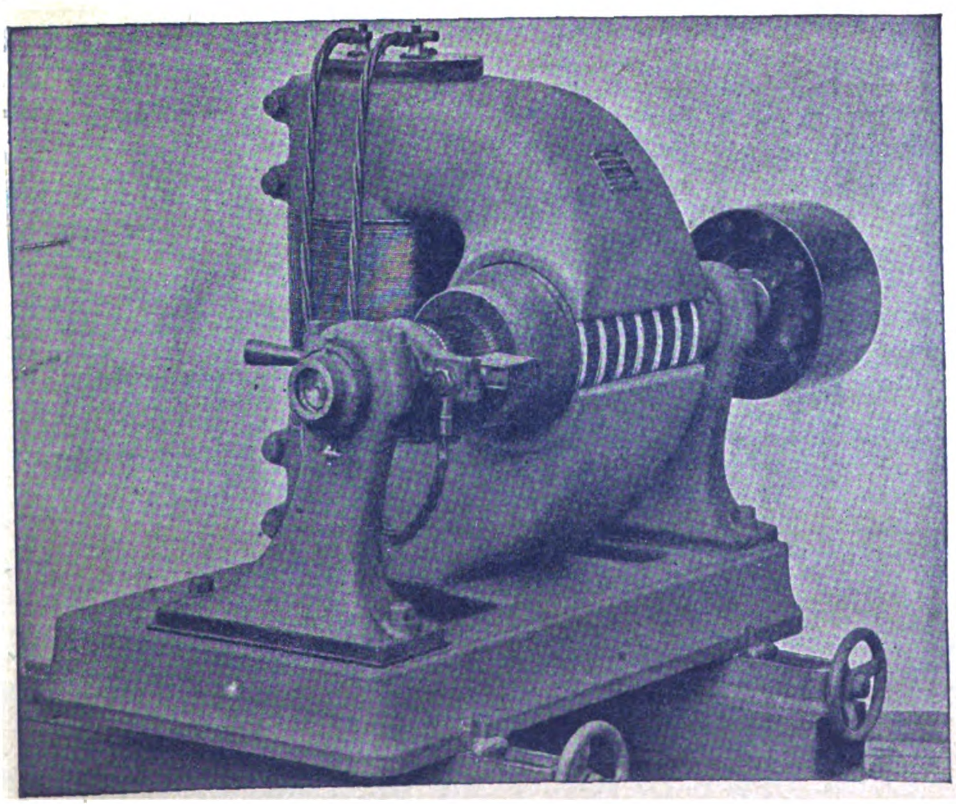

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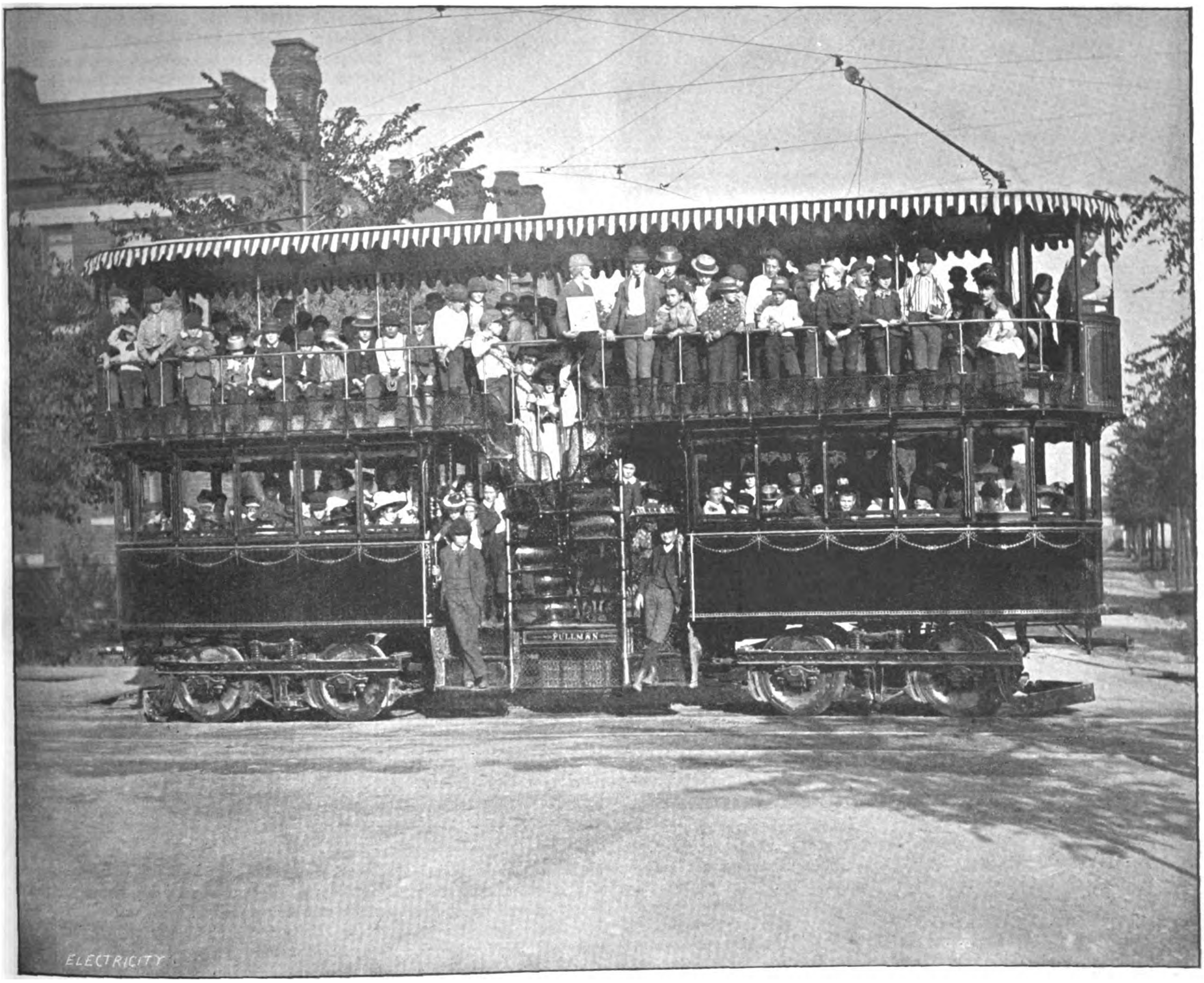

THE PULLMAN CENTER-VESTIBULED STREET CAR, WITH TOP SEATS.

(*See page 164.*)

THE PULLMAN CENTER-VESTIBULED STREET CAR, WITH TOP SEATS.

A novel street car was exhibited to a number of persons interested in street railway work at the shops of the Pullman Palace Car Company last Thursday. This car, which is illustrated in our frontispiece, is of the double-deck pattern, and is the joint invention of C. L. Pullman and E. G. Sessions, of Oakland, Cal.

The car exhibited was equipped with two Westinghouse single-reduction motors of twenty-five horse-power each. The motors are mounted on trucks of special design and are so arranged that they can be easily reached through trap doors in the floor of the car.

Interior View of New Pullman Electric Car.

A double brake attachment, which clamps all of the eight wheels, the invention of H. H. Sessions, manager of the Pullman Car Works, was used in exhibiting the car. The efficiency of this invention was demonstrated by the stopping of the loaded car within its own length, while going at a speed of twelve miles an hour.

In general appearance the car resembles those in use in Paris and London, but is much handsomer in design and finish than anything that has been put in service either in this country or in Europe. It is thirty-two feet long, seven feet and four inches wide, and fourteen feet nine and one-half inches high. The chief aim of the inventors was to design a car with double the usual carrying capacity. The car will seat forty passengers on each deck, and it is estimated (according to street railway practice) that at least eighty more can find standing room, making the carrying capacity of the car one hundred and sixty.

The car body is so arranged that passengers may enter at the center from either side, spiral stairs leading to the upper deck. Four stairways, combined with two at the bottom, separate toward the top, leading to either end of the car. The entrances at the center occupy no more space than the end platforms on ordinary street cars. The lower car body consists of two compartments, each twelve feet long, with circular ends, seats being carried round the ends as well as at the sides. The upper deck is entirely covered with a wooden canopy attached to the pilot house. The car is provided with an electrolier and a double oil lamp in each compartment. Two Burton electric heaters are used in each compartment. In place of the old style bell-cord common to street cars, this one is supplied with electric bells, and push buttons are placed so as to be within easy reach of the passengers Another novel feature is an electrical indicator placed in the gangway, to show where vacant seats may be found on the upper deck.

The car exhibited on Thursday is finished in mahogany. The interior decorations and fittings are similar to those in the Pullman palace cars, such as costly panels of rare woods, upholstered seats, burnished brass railings and many other very ornamental appliances. The upper deck is so arranged that curtains may be drawn to shield the passengers during stormy or cold weather.

Of special interest to electrical men is the fact that electricity is here used in many ways to add both to the comfort and safety of the passengers. Besides acting as the propelling force, it is used to light and heat the car and to ring bells and operate indicators, and in case of accidents it can be applied to suddenly stop the car. Two trolley poles are placed on the roof of the upper deck, one near each end of the car. The poles being short, it is claimed there is less chance of their leaving the trolley wire. An advantage is gained in placing the motorman in a small compartment built out from the end of the upper deck, inasmuch as he cannot be interfered with by the passengers and is always in a position to see clearly the track ahead of him.

The combined weight of the car, trucks and motors, is 28,000 pounds, and the total cost in the neighborhood of $3,500. Although this car is more expensive than the ordinary street car it is stated that per seat it costs about $20 less to build. Although the car exhibited this week was operated by the overhead trolley system, it can be readily changed so as to use storage batteries. The street car department of the Pullman Palace Car Company have now under way four more cars of the same pattern. Two are to be equipped with cable attachments and will be used to experiment with on the cable roads in Chicago and other cities. These cars are to be set two feet lower than the electrically equipped ones.

A new company has been formed by Chicago capitalists to manufacture cars of the pattern described above; it is the intention of the company, when in operation, to design and furnish cars of such a type that one of the compartments may be used for a smoking room and the other reserved for ladies. This arrangement would afford a happy settlement of a question that is often agitated in the newspapers of our large cities.

Among those present at the trial trip were Henry Villard, of the Edison General Electric Company; J. S. Barclay, of the Westinghouse Electric Company; C. L. Pullman, Marshall Field, John R. Walsh, Gen. McNulta, Anthony Seeberger, Jesse Spaulding, Judge Lambert, Tree and Cyrus H. McCormick. All pronounced the trial a success, and it is expected that similar cars will be introduced immediately in a number of large eastern cities. President Whitney, of the West End Railway Company, and a number of other gentlemen from Boston, made a trip to Pullman to see the new car last week, and were so favorably impressed with it that they think of placing an order for a large number of double-deck cars with the Pullman Company. The company is so sanguine of the success of their new departure that they are enlarging the street car shops by a building 159x50 feet, and will probably increase their force of workmen.

Dr. Werner Siemens speaks thus happily of the science of which we are an exponent:

"Electricity is the child of this international century. International was its birth, and international were those who fostered and developed it. Electricity has bridged the space which separated nations, and it has joined them in the common work of the development of the science of this era, a science on whose threshold we stand, and from which the greatest blessings for humanity are hoped."

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WE are glad to notice that a verdict for $7,000 has been entered against the New York, New Haven and Hartford Railroad, as a result of the suit brought by the attorney-general of New York State to collect penalties for the heating of cars by stoves in violation of the law. This is an encouraging sign and we hope before long to see the deadly car stove abolished from every railway in the country. In fact we trust that no very long period will elapse before railway cars generally will be both lighted and heated by electricity.

* * *

IT is a good sign that the World's Fair authorities are actively agitating the question of providing proper facilities for transit to the fair grounds. This is a subject of the greatest importance, and worthy of the most thorough consideration that can be given it. One part of the discussion at the conference between the Exposition authorities and the railway men will be interesting to electrical engineers. Mr. Wheeler, president of the Chicago City Railway Co., objected to building a new cable loop in the Park on account of the cost. "Then make it an electric line," said President Baker. Mr. Wheeler thought the suggestion a good one and promised to consider it. Electric railway men will appreciate the point.

* * *

WE print this week an interesting letter from our correspondent at Montreal, in which he points out that the Electric Light Convention recently held there has given the electrical industries in Canada a marked impulse. Those who attended the Convention will be glad to learn that it has had results of practical and permanent value, and that such pleasant recollections of their visit linger in the memories of their Canadian hosts. Another point of interest in the same letter refers to a valuable object lesson in electrical engineering and its achievements which the owners of a large isolated electric light plant invite all and sundry to profit by. The engine and dynamo room is open for public inspection, an engineer in uniform being in attendance to explain every detail of the machinery and apparatus. This is an idea which those in charge of large plants in this country might find it profitable to adopt.

* * *

A MINING engineer, who evidently writes from long and varied experience, contributes to our columns this week a studious article giving some "Suggestions to Manufacturers of Electrical Mining Machinery." These hints are well worthy of the attention of those for whom they are specially intended, and of manufacturers in other branches of electrical industry as well. Our contributor describes, in a manner that can but convince even the most skeptical, the many errors that have been committed by electrical construction companies in their endeavors to apply electricity to mining purposes. He points out for the benefit of those who have not yet learned all they might from that stern tutor, experience, and of those who may intend to embark in this line of work and have their experience yet to gain, how those errors may be corrected and avoided in the future. This article will be read with profit by every electrical engineer interested in mining work into whose hands it may fall.

* * *

BUT even a broader lesson may be read to electrical manufacturers in general from the text which runs through the article by "Mining Engineer." He makes the point that the manufacturers of electrical mining appliances have not properly studied the requirements of the business to which they are anxious to cater. This holds good in many other branches of the electrical industry. There have lately been many complaints in electrical circles of hard times, and the reason is apparent to anyone who looks beneath the surface. There are too many electrical firms carrying on the same class of business on the same lines. There is no attempt on the part of the newer firms to open up new avenues of trade, by intelligently studying the requirements of fields where electrical appliances would soon gain a firm footing if systematically introduced. Electrical corporations are too often organized under the executive management of men who have not even a bowing acquaintance with electrical science, either on its theoretical or practical side. Such corporations cannot but closely follow the lead of older concerns, and the man at the helm is often so lacking in the necessary experience and knowledge of the rocks and shoals in the course, that disasters are by no means of rare occurrence. Most of our electrical manufacturers would probably resent the imputation that they are lacking in originality and enterprise, but a careful survey of the field leads irresistibly to the conclusion that in many cases the charge is well founded.

* * *

THE trials and rebuffs to which an inventor who is not amply endowed with this world's goods has to submit are picturesquely described in our columns by a writer whose pen is apparently acidulated with the gall of bitter experience. We can hardly endorse all his scathing criticisms of the Patent Office, although some of the points he makes will undoubtedly be appreciated by unlucky inventors with whom fate has dealt hardly. It is beyond question, however, that the Patent Office is not maintained by the government in that state of efficiency which should characterize it, and which American inventors have a just right to insist on. It is generally admitted that inventors have done more to place this country in its present superb position among the nations of the world than any other body of American citizens, and it is a crying injustice that those who hold the reins of government should persistently neglect the interests of this most productive class. Mr. Quackenboss will call forth sympathetic pangs from the hearts of many inventors when they read that part of his article where he graphically sketches the impregnable position of the great inventor, who, with every resource at his hand which money can command, obtains broad and sweeping claims on every germ of an idea that occurs to him or to those associated with him. Often these ideas are productive of no practical results, but merely bar the way to those who might achieve them, if it were not that the other has "covered the ground" —not because he expects to reap, but that others shall not sow.

* * *

THE Rapid Transit question in New York has now reached a phase bordering on a public scandal. From the very beginning the manner in which this vitally important subject has been handled has been farcical in the extreme. The entire history of the Commission is a string of ridiculous errors, and the climax comes when a leading New York journal, deservedly famous for its temperate and public-spirited treatment of questions affecting the interests of the public, more than hints that recent actions of the Commission are tainted with a grave suspicion. It is pointed out that the plans of construction which the Commission favors will open the coffers of the city treasury to such an extent that Tammany Hall will reap a rich harvest. The method by which the Commission has secured these plans has a Gilbertian touch which savors strongly of the comic opera stage. After spending some months in receiving plans from engineers, eminent and otherwise, and more months—weary months these—in "considering" those plans, the Commission calmly brushed them all aside and instructed the two engineers employed to assist it to draw up plans of their own. The plans drawn up, the Commission secured the services of four eminent civil engineers to examine and report on them. As far as can be learned, none of these reports is very favorable to either of the plans proposed by the engineers attached to the Commission. Even if the reports had all been favorable the fact remains, as our New York correspondent points out, that the Commission has deliberately put aside a system of construction which is a pronounced success in favor of a system that admittedly has many defects. The first system would cost $1,000,000 a mile and would attract private capital, the second will cost twice that amount and New York City is to foot the bills. Surely the citizens of New York will be in accord with the *Evening Post* in demanding of the Commission an explanation of its extraordinary proceedings.

THE TRIALS OF THE IMPECUNIOUS INVENTOR.

BY P. P. QUACKENBOSS.

The true inventor needs more than the generality of readers will imagine to produce in this rapid age anything of value to his fellow men. He must possess genius--not the genius of the Artisan, but of the Artist--the power to create, not to elaborate. He must be patient, considering every detail relating to his discovery, not rushing into print and patent office with half-digested ideas that require the subsequent supervision of trained experts to reduce to practical shape. He must have sufficient means to support himself and his family--if he possess one--and to produce practical evidence of his discoveries in order to illustrate to the capitalist or promoter their advantages. He must be forbearing under rebuff, indifference or ignorance on the part of those whom he seeks to enlist in his support. Then if he has produced a valuable improvement in any branch of trade that proves to be a practical step in advance in the art, let him at once ally himself with some one or more energetic, conservative associates, giving them absolute control of the business part, and holding them responsible for its success; remembering that if he is dissatisfied, he still retains the creative power that produced the first improvement, and that he still lives.

Now allow that he possesses the necessary qualifications and prepares himself to apply for letters patent. He seeks an attorney, and possibly being without knowledge or experience, places himself in the hands of the first whose advertisement catches his eye. The attorney by long practice may have become theoretically familiar with mechanics--sufficiently so, at least, to impress our inventor with an exaggerated idea of his ability--and after consulting once or twice with his client, draws up his specification and claims, as nearly like the thing as *his* spectacles will permit, yet in reality not so much so as to give the *inventor's intentions* to the examining clerk in the Patent Office. Then the fun begins.

The assistant examiner, in whose hands the matter is placed, is only in rare instances a man technically trained and competent to judge and discriminate in the branch of science or art over which he exercises his censorship; and the most disgraceful fact stares us in the face that the great, powerful, rich government of the United States is too parsimonious to pay proper salaries to secure intelligent, capable officials to carry on the most important sub-department under its control. It is of no use to try to shut our eyes to the fact, as it is proved by the enormous amount of labor thrown on the already overworked judges of our courts by the faulty and imperfect work of the Patent Office. No argument is possible in such cases. This poor examiner, not properly paid though not overworked, no sooner acquires even a smattering of knowledge at the public expense than he at once resigns his position and hangs out his shingle as a full-fledged "Patent Solicitor." In course of time he becomes, by regular progression, also an "attorney," but it is in his "chrysalis" state that he is presented here (or rather let me say, tadpole condition), and his crude and many times faulty conception of a novel claim in which an expert is needed has brought unusual and unnecessary distress and damage to the poor inventor. It is not intentional on his part, for poorly paid as he is, the examiner wants to do what is right, but he reminds me of nothing so much as a toad in a rut; the whole world to him is a straight and narrow track; and that brings us to another danger, the lack of proper experts in some of the different departments.

I am aware that it is claimed that the Patent Office does possess leading experts on its staff in every principal line of business, but on considering the salary for such service, and comparing it with the sums such ability would command in the markets of the world, I confess my skepticism. As an instance in point, permit me to relate a short story. Not very long ago a man in New York made a discovery that secured for him the countenance and assistance of a well known multi-millionaire. He applied for letters patent. His claim was rejected; it was ridiculed; it was impossible, absurd, in fact *anathema maranatha* was hurled at it. He persisted and insisted upon the practibility of his invention, and offered to pay all expenses of any expert investigation the Patent Office should desire. After considerable pressure, a government official of universally admitted capacity was duly delegated, and authorized by the Office to visit the factory and report whether in his expert opinion the discovery was worth taking further steps, or was another "Keely Motor."

This gentleman in due course of time called at the shop in a side street where the crude model mechanism was at work, and taking off his gloves, remarked, "I have got about two hours to give this matter I think, so let me see the wonder." He saw it; he spent *three days* over it and as he left for Washington, he impressed upon those in control of it the necessity of going ahead with it in a certain direction. This was an acknowledged expert, and yet to get his services the Patent Office had to borrow, not possessing the control of such ability, in spite of the fact that the office demands and receives a fee of twenty dollars in each case preliminary to making any investigation. That sum is many times the value of the service rendered, as the profits of the office show, and in case the inventor is poor and his discovery has been anticipated, the office does not return any part of this sum, but "swipes" the whole of it. I am aware that many suggestions have been offered by men of more than average ability, containing in themselves the germs of great practical reforms, but popular indifference has invariably allowed them to wither before fruition.

There is still another danger before the humble inventor, perhaps the most serious of all. And that is, the "great inventor," who is backed by some large corporation, whose reputation has been made by the newspapers, and who has at his command the men and machinery, scientists and capital, to insure the development and perfecting of his ideas and of those of others. He reaches out his hand to cover the territory of his struggling neighbor, absorbing his efforts without requital and with dignified severity repressing the attempt to find a foothold near the pinnacle sacred to his fame and his honor. With what assiduity every professional authority—whether retained or not—endeavors to uphold the prior rights of the great inventor, and destroy the hopes of the smaller one, only those who have passed through the mill can appreciate. They are waiting and praying for congressional action to recognize at last the element that has had the greatest effect in securing the high position that this great nation holds in the eyes of the world. To all such I recommend the study of one word—Patience. The present mighty if silent struggle in the field of electrical science presages great changes.

THE MIXED STEAM AND HEATED AIR DELUSION.

"The use of steam mixed with air in engines has again been attempted, this time in England by Mr. Edward Field, C. E. Previous attempts have resulted in failure. The present effort seems to have captivated the imaginations of some sanguine persons, and it has been heralded as revolutionary in its character. The printed descriptions of the way in which the air is used in conjunction with steam do not encourage the belief that anything new and valuable has been discovered; but until a clearer statement of the principles which are asserted to underlie the alleged improvement is made, we prefer to maintain a skeptical attitude as to the economy claimed for it."—*The Engineering Magazine* for October.

Readers of Electricity will remember that in our issue for August 19th we denounced this so-called new motive power in unqualified terms. We were the first to call attention to the absurdity of the many claims made for it. To our surprise most of the mechanical and engineering journals either tacitly or specifically endorsed the scheme as a great discovery, and we have looked in vain until now for editorial or other comment showing it up in its true light. We were not surprised, therefore, at the receipt of letters from misguided or over sanguine persons who characterized our criticisms as the outgrowth of ignorance.

We congratulate *The Engineering Magazine* upon following the lead set by Electricity in warning its readers against the steam and air delusion.

ELECTRICAL CURRENT TOPICS.

Mr. Edison has announced a new invention to the newspaper reporters—it is curious, but somehow the newspaper reporters generally get ahead of the technical journals in giving to the public the details of scientific inventions. From the published descriptions we should imagine that Mr. Edison has been amusing himself at the expense of the reporters, or that these versatile gentlemen had got things considerably mixed during the journey from Llewellyn Park to Printing House Square. The invention is "to pick up current through the rails, especially when the rails are covered with mud." Furthermore the reporters learn that Mr. Edison's system "will be from two to three times cheaper than the use of cables, and about one-third as cheap as the trolley system."

Those of our readers who have a taste for mathematics can work out for themselves the difference between "three times cheaper" and "one-third as cheap," and then deduce the relative economy of the cable, the trolley and the new system.

* * *

Naval experts in England are excited over the coming trial of the Sims-Edison torpedo, which will be operated this week from the deck of the munition transfer steamer "Drudge," moving at the rate of eight miles an hour, with its broadside towards the object to be attacked. Naval men say the cable connecting the torpedo with the vessel is sure to foul the screw, but Mr. Sims proposes to throw overboard an electric junction box, which will pay out the cable both ways at once. After the trial Mr. Sims will go to Kiel to make a test in the presence of the German Emperor, and will probably then make trials at Odessa before the Russian experts. The company will sell torpedoes to the British Goverment at a cost of $8,000 each.

* * *

Mr. Osborne Howes, one of the commissioners from Massachsetts to investigate rapid transit in Europe, is now on his way home. In his opinion, America is ahead of Europe so far as long distance journeys are concerned, but no American city is nearly up to the principal European cities for rapid local and suburban traffic. Mr. Howes thinks that the Greathead system of electric railway, now used in South London, may be considered for rapid transit in America.

* * *

The electric light has just had a novel application. There is an estate near Bournemouth, England, where, for a long time past, poachers have been making serious depredations. It was determined to have a strong search light turned on from Hurst Castle, some three miles off, and by its aid the poachers were surprised at their

work. The men took to their heels, leaving in their flight hundreds of yards of nets which they had laid for the drive. Their flight did not avail them anything, for they had been recognized in the strong light and were subsequently arrested.

* * *

The tendency of the times is strongly indicated by the character of the subjects discussed at representative gatherings, such as the International Congress at Frankfort.

Two or three years ago the electrical world was astounded at the boldness of the proposition to transmit electrical energy from Deptford to the heart of London at a potential of 10,000 volts. There are many who proclaimed the utter impossibility of insulating against such an enormous pressure and few to admit its practicability.

* * *

We had scarcely become used to the idea of working at 10,000 volts, when another proposition, eclipsing the former one in its magnitude, of transmitting power from Lauffen to Frankfort—a distance of over 140 miles—at a potential of 30,000 volts was broached. The successful accomplishment of this last project has led electricians to consider the practicability of using still higher voltages, and one prominent engineer in this country pronounces it perfectly feasible to transmit energy from Niagara Falls to Chicago, a distance of about 475 miles, at 80,000 volts.

* * *

The late International Congress at Frankfort has already been dubbed the "High-tension Congress" by reason of the glibness with which 10,000 to 100,000 volts were discussed as available potentials for power transmission.

* * *

Alternating currents have also come into particular prominence by reason of their ready transformability from one potential to another, as being the most practical solution of the question of transmission at high pressure and utilization at low pressure.

In these applications the multiphase alternating current motor employing a rotating magnetic field is attracting much attention.

* * *

The present system of charges for the use of telephones by annual subscription is by many considered unjust, inasmuch as some subscribers speak often and much, whereas others use the telephone only occasionally.

In some German telephone offices an electrically driven clock is attached to each telephone, which will work as long as the telephone is off the hook, and stops directly it is replaced the service is charged for according to the time recorded.

It is claimed for this system that unnecessary conversations are prevented, that those that take place are limited to reasonable length, and the useful efficiency of the whole installation is increased.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

Electrical Engineer Keller, who has taken Secretary Hornsby's place while the latter is in Europe, is busily engaged in getting out a prospectus of the Electrical Department of the World's Fair. It is the intention of the department in issuing the prospectus to prepare something that will be very readable and well illustrated, and will present the matter in such a shape that manufacturers of electrical machinery and supplies shall be impressed with the necessity of being well represented at the exposition.

The office work of the Electrical Department has assumed a routine nature. Weekly meetings of the committee on electricity are held. Numerous letters, containing inquiries in regard to the exhibits, are received daily, showing that a lively interest is taken by electrical men all over the country.

On the grounds at Jackson Park work is being vigorously prosecuted. Mr. Johnson, contractor for the Electricity building, is constantly adding to his large force of men, and is satisfied that he can finish the building several months before the contract time. Although the building at present looks as if very little had been done, the carpenters have 1,500,000 feet of lumber worked up and ready to be placed in position. Eighty-five car loads of lumber for the building are standing on the track waiting to be unloaded. The first of the iron work arrived this week from Pittsburgh and word has been received that the remainder will be forwarded during this month.

The temporary electric light plant was started up last week. Poles have been put up and wires are being run to all parts of the grounds for lighting the buildings. For the present only the offices, lunch-rooms, barns and fire station will be lighted.

The construction of the elevated sidewalk between the Women's and Illinois state buildings is well advanced and the iron rails are being placed on the timber superstructure. The power house has been completed and an Ideal engine and a Thomson-Houston generator have been installed. Arrangements are being made for a trial trip by the end of the month.

The Engineering Department has recently gone over the plans for the Electricity Building and discovered an error in estimating the strains on the foundation. With the advanced stage of the work it thought that an extra expenditure of $75,000 will be necessary to strengthen the structure. Architect Van Brunt of the Boston and Kansas City firm of Van Brunt & Howe, is in the city to revise the plans for the construction of the building.

At a meeting of the committee on transportation, held this week, to consider the question of carrying passengers between the city and the grounds, President Wheeler, of the Chicago City Railway, objected to the proposed State street loop on Sixty-third and Sixty-first streets, on the ground that it would necessitate the erection of a new power house and would cost the company $250,000 dollars. It was suggested that an electric railway over the loop would be a cheap and satisfactory solution of the question.

THE STREET RAILWAY CONVENTION.

It is expected that the approaching convention of the American Street Railway Association, to be held at Pittsburgh next week, will attract a larger attendance than any previous meeting in the history of the Association. A very large number of delegates have signified their intention of being present, the unusual number of electrical papers announced having inspired widespread interest in street railway and electrical circles. We learn that Mr. Oscar T. Crosby will read a paper on "Standards in Machinery and Appliances for Electric Railways."

MORE ABOUT THE IDEAL MOTOR.

Those who have noticed by comment in this journal the results which Mr. H. Ward Leonard accomplishes by his new method of operating electric motors, will be interested to learn that Mr. Leonard announces a further and most important improvement of his method. By a slight modification in a central station plant, not in any way affecting the operation of existing devices, any motor on the circuit can be controlled so that it will operate in either direction and automatically at any desired speed and torque, and with high efficiency under all conditions. Mr. Leonard's first development of this method made it necessary, when using his motor from a central station circuit, to use the equivalent of a transformer of the energy. By this later modification the transformation of energy is done away with; consequently the first cost will be no higher than for shunt motors of the type in use to-day, and yet all the advantages of the perfect control obtained by this method will be secured. No change in the generators, conductors or translating devices, with which central stations are now equipped, will be required in order to accomplish this result.

SUGGESTIONS TO MANUFACTURERS OF ELECTRICAL MINING MACHINERY.

BY A MINING ENGINEER.

Why has the introduction of electrical appliances in mining operations been so slow? This is a question that has puzzled the manufacturers not a little, for it would seem as if mining were a field to which electricity is peculiarly adapted. To the mining engineer and those conversant with the situation the answer is not far to seek.

In the first place mining communities have characteristics peculiar to themselves and these must be thoroughly understood and catered to by the merchant or manufacturer who would do business with them. The food they use, the clothes they wear and above all, the machinery they employ, must be particularly adapted to their wants or their traditions, and these vary materially in different countries, in different sections of the same country, and in mines of different classes in the same or neighboring localities.

Precious metal mining is as different from coal or iron mining as day from night, and however skillful or expert an individual may be in one, his training will avail him nothing in the other. The method of ventilation in one is totally inadequate or unsuited to the other. A drill, a mining locomotive, hoist or pump that would do good work in a gold mine would be useless in a coal mine and vice versa, and the after treatment of the products from these two sources is in no wise similar. To successfully carry on business in any mining district one must be practically familiar with the customs, the economic conditions and the people of that district. In the early days of gold and silver mining, when we had no educated mining engineers of our own, men of large experience in this line were brought from France and Germany. The failure of such experts to conduct the enterprises in which they were engaged so as to achieve commercial success was so general as to become proverbial. Their failure in most cases was due neither to their lack of skill nor to the quality of the deposits they were called upon to work, but to a total lack of appreciation of the new economic conditions by which they were surrounded.

The precious metal miner of our western country is conservative to a high degree and his conservatism is justified by his past experience. In the early days new processes and machines for treating ores were constantly being foisted upon the market, backed up by all sorts of possible and impossible claims; and this is still the case. These have in the past been tried on their merits and have so generally failed of their purpose that the old miner is apt to look with suspicion on anything new pertaining to his profession. Not only that, but they regard with distrust machinery, even of established types, which is made by any but a few of the older manufacturers.

So necessary is attention to minutiæ in mining machinery that new concerns, although they may work from correct drawings, are almost sure to turn out a product unsatisfactory in some essential particular. It is a fact, I believe, that mining engineers of large experience confine their patronage to the old-established houses, and the newer candidates for favor in this business get most of their custom from those less versed in mining matters.

In the mining camps distant from railway communication, experiments cannot and should not be tried. The engineer in ordering his machinery must *know* that when it arrives it will meet the requirements, and when he hears of electricity, about which he may know nothing, his confidence is not increased on finding that the agent is a "tenderfoot" and does not know the difference between a free milling and a smelting ore.

The agents of our electrical manufacturing establishments have approached the miner on his least vulnerable side. They have offered to light the gangways and stopes of his mine with electricity—a luxury—but until recently they have offered him no means of operating his drills or pumps—a necessity. If he were already provided with a compressed air plant, there was no inducement whatever to add to his expenses that of an electrical installation, when its only mission was to supplant the tallow dip or candle which had been all-sufficient in times gone by. The introduction of a practical electrical percussion drill has given the application of electricity to mining machinery a distinct impulse, but has not removed all the obstacles to its general introduction.

The western miner is an individual *sui generis*. He knows no social distinctions, and oftener than not considers a scientific man a helpless and pitiable creature, far beneath him in every useful attainment. There is nothing he despises so much as a "city-bred chap" who knows nothing about mines or minerals, unless it be one who thinks he knows something about these things but does not. A coal miner is beneath his notice and he will not receive instruction from a member of either of these classes of individuals, yet often it is just such that represent our largest electrical establishments in the west. Nor does the fault lie alone with the class of agents sent out. How many of our largest establishments employ experienced mining engineers to design machinery for this trade?

Not many years ago the writer was asked to pass on the merits of a lot of patents on mining devices taken out by a man employed for the purpose by a prominent electrical corporation. It was apparent after an inspection of the patents that the inventor had had no experience whatever in mining. There was a pile of several dozen patents and not one was practicable. When the writer expressed this opinion, the inventor replied that he was under the same impression, but hoped to cover the ground with his patents and develop them afterwards.

Another establishment employed as its chief mining expert a recent graduate from one of our best mining schools, who had never done a day's actual work in a mine. This young man aired his information on mining matters before the scientific societies and in the advertising literature of the company with which he was connected, doubtless to his own edification, but to the practical miner his productions were almost nauseating. Another prominent company employed in the same capacity a gentleman who, while not an engineer by education or profession, had had some experience in coal mines in England. Now English practice is not American practice, and however well versed he might have been in the former he was by no means qualified to advise in regard to American mines. Not only this, but he was given jurisdiction over the precious metal mines of the west—not one of which had he ever seen.

One of the gentlemen before referred to submitted to me plans of an electric mine locomotive which he had prepared. Totally unaware of the sharp curves that are the rule rather than the exception in mine tracks, he had provided the locomotive with such a large wheel base that in order to pass some of the curves likely to be met, the front axle would have to take a position nearly at right angles to the rear one, and yet no provision whatever had been made to meet such a contingency.

All of these men were bright and competent as electricians, but they were called upon by their employers to develop a business about which they were totally ignorant. Is it any wonder then, that the miner has been slow to adopt electricity when the machines he has been asked to use were designed by people so little familiar with the requirements they would have to meet?

Would the fact that such machines were recommended by what he contemptuously terms a "tenderfoot" dispose him more favorably towards an innovation regarding which he already had serious doubts? When we understand that in one section of the country double hand drilling is exclusively in vogue, while in another the single hand method alone is employed; that the metal miner prefers a piece of star candle stuck to the wall of the working, to the more convenient coffee-pot lamp carried in the hat of the coal miner; that the Mexican prefers the straight pointed iron bar to the American pick—when we realize that these prejudices are so deeply seated that it is almost impossible to eradicate them, then we shall understand the necessity of catering to local tastes. Then will our electrical manufacturers employ as designers men who understand the requirements of mining machines, and be represented in the field by men who by their practical knowledge of the business will inspire that respect among those whose trade they solicit which only a thorough knowledge of mining can command. Then may we expect a rapid and healthy growth of the electrical business in the mining field.

One word more—do not send a coal miner to solicit trade among the gold fields, for the chances are that he will be treated with contempt; do not send a gold or silver miner to the coal mines, because he is unfitted for that work; and above all do not send an over confident man with no mining experience to miners of any class, for he will do you more harm than good.

MAGNETISM IN TOOLS.

The question "what causes magnetism in tools" is agitating one of our contemporaries who, although suggesting certain theories, does not hit the nail on the head.

Neither heat, friction, nor position of tool is the sole cause of this phenomenon, but it is due to a combination of position and vibration.

It is well known that vibration greatly assists change in the magnetic state of a piece of iron placed in a magnetic field, and Ewing has shown this quantitatively by a series of curves derived from actual experiment.

The phenomenon of hysteresis, or the lagging of a magnetic effect behind its cause, which is existent in all qualities of iron and steel, in soft annealed iron least and in hardened steel the most, is almost entirely obliterated in the former, and greatly lessened in the latter, when the bar is subjected to vibration.

A simple experiment, within the reach of nearly every one, to show this effect is the following:

If an ordinary wrought iron poker be held in a vertical north and south plane and one end be dealt a sharp blow, it will be found to have assumed polarity, which may be proved by presenting the ends in turn to the north-seeking end of a compass. One end of the poker will attract and the other repel. If now the poker be reversed in position and the other end tapped, the polarity will be changed, and the end which formerly attracted the north end of the needle will now be found to repel it.

The maximum effect is produced when the bar is held parallel with the dipping needle, and it gradually disappears as this angle is departed from, until, when held at right angles to the dipping needle, no polarity is developed by the blow, and if the bar already have polarity, it may be completely removed by striking the bar when in this latter position.

Since a dipping needle may not be accessible, this latter effect may be easily produced by striking the bar when held horizontally in an east and west position. It will then be at right angles to any vertical angle in a north and south plane. As before stated, the bar will acquire no polarity if struck when in this position. This is not strictly true however, as it would be magnetized transversely, but its dimensions in this direction being so small compared with its length, the magnetism would be too slight to be detected in the ordinary way.

In the example given, the magnetic field is due to the earth's magnetism, whose lines of force take a nearly north and south direction and tend to thread an iron bar held parallel to them. The magnetic reluctance of the bar, or the resistance which its molecules or molecular magnets offer to an arrangement in conformity with these lines is overcome or lessened by any means of molecular vibration. In some cases the mere tremor of the earth is sufficient in this magnetic field to permit of this re-arrangement. In others it requires a more violent vibration, such as may be caused by heat, by friction, or by a blow, and it not infrequently happens that these agencies must be long continued to produce appreciable results.

The magnetic reluctance of different samples of iron or steel varies not only with their quality and temper, being least with soft annealed iron and greatest with hardened steel, but also with the past history of the bar in question.

It is found that a bar which has once been magnetized in a given direction and demagnetized will more readily again take magnetism in the original direction than in the opposite one, and although two bars may be of identically the same composition and hardness they will vary in their susceptibility as the stages through which they have passed in the course of manufacture have varied. So that it has been well said that the susceptibility to magnetism of a given bar, is the resultant of all the influences to which it has been exposed in and since its manufacture.

ELECTRIC HEATING.

The success which has followed the efforts of the Electric Merchandise Company to inculcate among railway men an idea of the practicability of electrical heating is certainly of general interest. The Burton Electric Heater, which is the apparatus handled by this company, has been under public notice during the past three years. At the outset, naturally, it was looked upon as an experiment and its utility could not be vouched for. Since then, however, actual use of the heater has proved its success as a heating contrivance.

The Burton Heater claims attention as the first electrical invention of the kind to be put in regular service. Now that the practicability of the method of electric heating has been demonstrated, it is but natural to expect that so useful an invention will soon be in general use.

Since railways first developed the need of car stoves, the latter have been the cause of many disasters and of much discomfort; at one extreme setting fire to overturned railway coaches, thus inflicting a horrible death upon their occupants; at the other, filling our street cars with foul gas and troublesome smoke. The removal of these dangers and discomforts would add in no small degree to the welfare of mankind. Besides this boon to the public, there is another point in connection with railway management that may well be considered, and this is particularly applicable to electric street car lines. The time, attention and expense demanded by the use of the car stove may be greatly reduced by the employment of the electric heater. An electric heater being much

less complicated than a stove, has necessarily a longer life. Fewer working parts make the cost of repairs less. The electric heater requires the least possible attention, while a stove must be continually watched. The annoyances common to stoves are entirely absent from the electric heater. No ashes, no coal or coal dust, no soot or dirt whatever, no gas, smoke or suffocating odor. The cars do not require ugly smoke pipes and are not disfigured by scorching.

A large number of street railway companies have already become convinced of the usefulness of electric heaters and have placed them on their lines. In speaking of electric heaters not long since, the president of one of the largest street railway systems in the world said: "Electric heaters are much cheaper to operate than stoves; if a manufacturer of the best stove made for such purposes offered to equip 400 cars for me gratuitously, I would reject the offer, now that I can have electric heaters."

Numerous electric power companies are influencing their patrons to place heaters in their homes and offices, and this is not done solely to increase the receipts of the company, but because in the electric heaters these companies recognize a contrivance which must necessarily make life easier for those persons obtaining current at their hands. Where water power is available for generating purposes the unusual economy of electric heaters is a feature most conducive to their general use.

ANNUAL DINNER OF THE WISCONSIN ELECTRIC CLUB.

The Wisconsin Electric Club held a decidedly enjoyable banquet at the Plankinton House, Milwaukee, on the evening of October 8th. About fifty people, including most of the prominent electricians of Milwaukee, and several guests were present. In the opening speech President A. J. Rogers gave some very clear ideas of the wonderful progress of electrical science. Prof. Warren S. Johnson, in speaking of "Limitations, Electrical and Mechanical," said that he doubted if electricity would ever haul a train of cars faster than steam. He also doubted, he said, if the maximum speed of a steam locomotive has yet been attained. W. K. Gibson made an eloquent address on "The Electrician as an Inventor." D. E. Jackson, of Madison, spoke on "Underground Distribution." He stated that the system of distribution of electric railway wires and the system of distributing incandescent light wires used by the Edison people in Milwaukee were the most perfect of their kind in the country. Electricians, he further declared, were still bound to have considerable trouble in solving the problem of underground distribution.

LITERARY NOTE.

We are in receipt of the advance proofs of a little pamphlet to be issued by H. Ward Leonard & Co., in which they point out the assistance that can be rendered to intending purchasers of electrical apparatus and others by independent and competent consulting electrical engineers.

Though intended for the furtherance of the interests of the publishers in particular, it is not obtrusively so, and the hints and suggestions given are such as might be offered by any person thoroughly conversant with the situation and with no personal ends to gain.

We welcome this little brochure, not as an advertisement, but as an intelligent bit of advice, the soundness of which cannot be gainsaid.

Another useful application of electric devices. On Friday, Oct. 10th, a mob took a brute from jail in Omaha and strung him up to the overhead trolley wire, and yet some people say these trolley wires are an unmitigated nuisance. This time they succeeded in mitigating one.

It is reported that the fishing around the Isle of Wight has been nearly ruined by the use of the search lights for the forts. At St. Catherine's Point, where the fishing was formerly excellent, it is said to be quite useless to put the nets out, whereas before the advent of the search-light, a few years ago, a decent haul was looked on as a certainty.

PROJECTORS.*

BY HAMILTON HUTCHINS, U. S. N.

PART II.

The following are the sizes of the projectors made by the Paris firm:

DIAMETER OF PROJECTOR CYLINDER.	NOMINAL CANDLE POWER.	WORKING CURRENT.	FOCAL DISTANCE IN C. M.
30 centimetres	6,000	20 amperes	16
40 "	12,000	30-50 "	24
60 "	20,000	50-80 "	33.2
75 "	30,000	80-100 "	54
90 "	40,000	120 "	76

The smallest (30 c. m.) is for use in steam launches or small torpedo boats. The 40 c. m. is used extensively in the vessels of the Italian navy. The 60 c. m. projector is the one in most general use by all nations. Fig. 5. shows the Mangin projector as designed and manufactured by the Thomson-Houston Co., and already supplied to several of our new cruisers, and Fig 6 the projector lamp, showing the arrangement of carbons and regulator. The 75 c. m. has recently

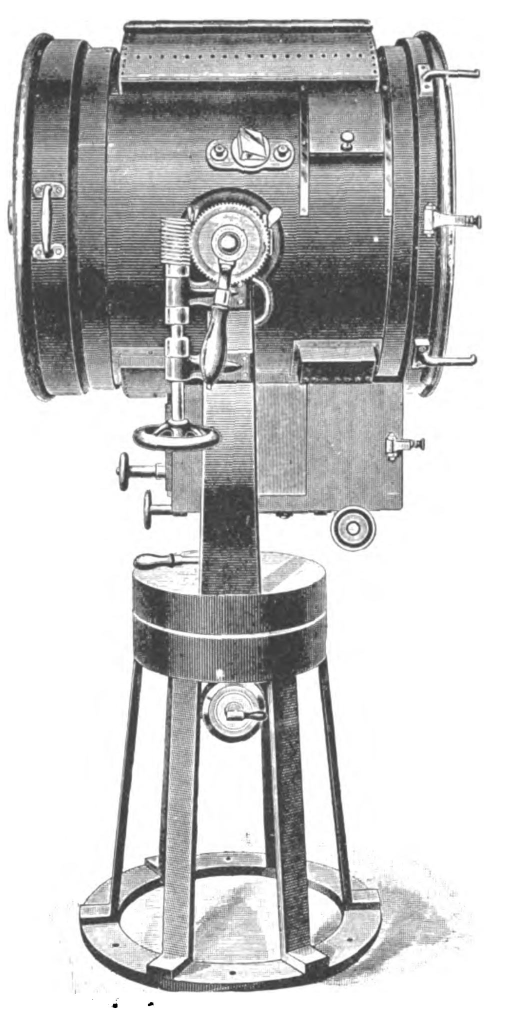


FIG. 5—MANGIN PROJECTOR, THOMSON-HOUSTON PATTERN.

been introduced, principally in the French and Russian navies. The 90 c. m. is too large for service afloat. With any of these projectors it is customary to supply a combination lamp; that is, one that can be worked automatically or by hand, as desired.

The operation of a search light system in its simplest form may be represented by single hand lamps operated by a series dynamo. For steadiness of working, however, it is preferable even then to have a small amount of dead resistance in series with the arc in addition to that required for the leads. In designing automatic lamps for use in main projectors, on account of the motion of the vessel, it is necessary for the feeding mechanism to be independent of gravity. For operating arc lamps in parallel or in parallel with incandescent lamps or motors, constant potential is required. These are the conditions on board ship.

In the United States navy the dynamos are compounded for the standard of 80 volts adopted by the Department. Fig. 7 shows one of the three generating sets of the "Newark," the latest addition to the fleet, consisting of a 200-ampere Thomson-Houston dynamo directly connected to a vertical two-cylinder double-acting Armington and Sims engine on the same bed plate. The three sets, running in multiple when desired, supply current for the incandescent lamps and for four 60 c. m. projectors. When the dynamo is supplying only one search light, it can be run at a potential slightly above 50 volts, which is about that required for the lamp itself, but when the light is fed in parallel with other arcs or incandescent lamps, it is necessary to insert as much as 15 or 20 ohms in series with each arc to prevent unstable working. Thus a certain amount of waste of energy is necessary for good working of arc lamps in parallel. Although 80 volts at the dynamo is somewhat higher than is necessary for the search lights alone, yet other considerations made it advisable to determine 80 volts as the standard when the dynamos are generating energy for the incandescent lamps and motors as well. But in any case, the length of time that the search lights are required on board ship is short compared to the time the incandescent lamps are in use, so that the proportionate cost of the waste of energy on dead resistance for an extended period is small.

For torpedo boats and steam launches one of the most successful search light plants consists of an M. Gramme dynamo mounted on the same bed plate with a 2¼ in. Brotherhood engine, the whole installation occupying a space of 2 ft. 4 in. in length, 1 ft. 2 in. wide and 1 ft. 6 in. high, and weighing 310 lbs. It is used to supply a current of 20 amperes at 45 volts to a single search light of a 30 c. m. projector.

As regards the amount of light obtained from the projectors, the 60 c. m. projector with a lamp taking 50 to 60 amperes, at 45 to 50 volts, may be said to give a nominal candle-power of about 15,000 to 20,000, for in the arc light with a direct current, the area of the crater, from which most of the light emanates, is a rough measure of the current strength, and these increase in approximately the same ratio as the candle-power of the light, the quality of the carbons causing the candle power to vary somewhat. A lamp taking 100 amperes would give about 36,000 c. p. at the same voltage. The size of the projectors has, of course, nothing to do with the candle power of the lamp, the only point being to make it large enough to stand the heat generated.

Coming to the arc itself, Prof. Fleming has recently shown that the difference of potential between the positive carbon and the arc flame is about 40 volts, with an arc lamp that operates with 45 volts potential, and the few volts which express the difference between the flame and the negative carbon make up the total potential of say 45 volts. Another point of interest in relation to the arc was discovered during experiments at the Thomson-Houston factory. It was shown that the light could be turned out and the arc completely extinguished for a full second, yet when the current was switched on the arc would be re-established. This was done repeatedly, showing that the hot gas was sufficiently conductive to re-establish the arc, even with a difference of potential of but 75 volts. The dynamo was run at 75 volts, of which the lamp took 50, the current being 50 to 100 amperes.

As with other apparatus on board ship, it is extremely necessary that the search light outfit should be simple, durable, light and efficient in all its parts. The working parts must be well protected from the weather, the carbons of good quality and there must be no undue heating. It is customary to use cored carbons and the upper

*Begun in ELECTRICITY for September 23.

or positive carbon, in order to get the best results in the amount of light thrown on the mirror, should be slightly larger than the lower. The upper carbon is coppered, not only to increase the conductivity, but principally to preserve a well-formed crater. The French and American fittings for the hand lamp and hand projector are practically the same, the main difference in the naval projector being in the base or pedestal. Except for the increased weight, the French cone base of thin metal is preferable to the open tripod or spider, as it affords greater protection to the connections and switch. The terminals also should be within the cone. The switch should be double pole and quick-acting. In the French navy it has generally been the rule, when working a hand lamp, to use a voltmeter connected to the lamp terminals but this is merely a refinement, and with a little judicious attention to the arc and crater neither voltmeters nor ammeters are necessary. With automatic lamps the use of these instruments is quite unnecessary.

The earliest type of projectors, and in fact all up to within the last few years, were manipulated by hand, but as it is now considered fatal to expose men to the enemy's fire for working by hand, the modern ones are trained and elevated by electric motors controlled from a dis-

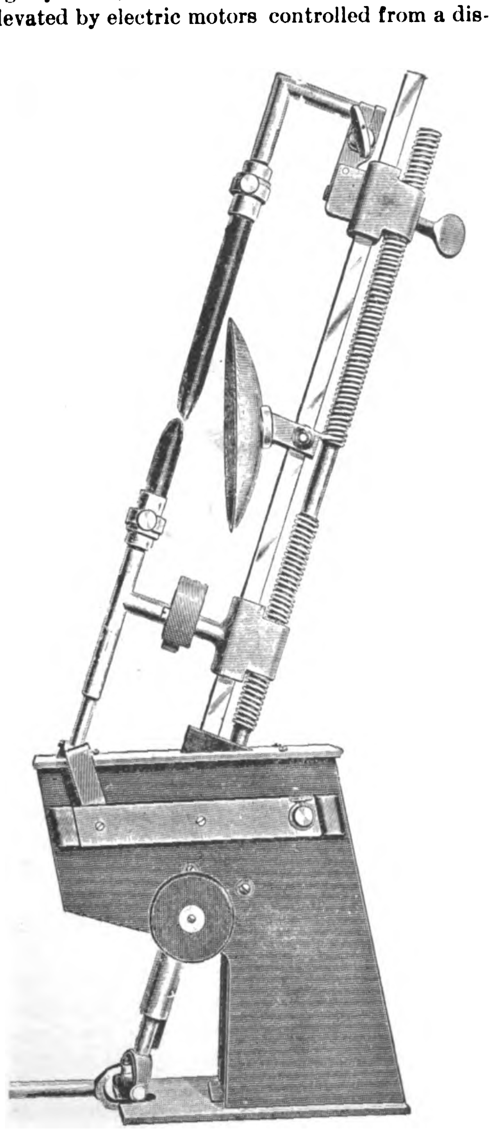


Fig. 6—Projector Lamp.

tance. The modern equipment of naval projectors may be described as follows:

The very latest improvement in search lights abroad is that which allows them to be manipulated from a distance, on constant potential circuits. Not only is the lamp automatic in every sense of the word, but electric motors are attached for training both horizontally and vertically. The motors are placed in the pedestal and a multiple cable runs to the controlling board, carrying the necessary switches for operating the projector and its lamp. The movement of training horizontally can be either continuous, as with a divergent beam when expecting an attack by torpedo boats, or by small angles at a time when a concentrated beam is required for long range. Under these conditions, the complete maneuvering of the projector, together with the starting and stopping of the lamp, is regulated by the switches on the controlling or switch board.

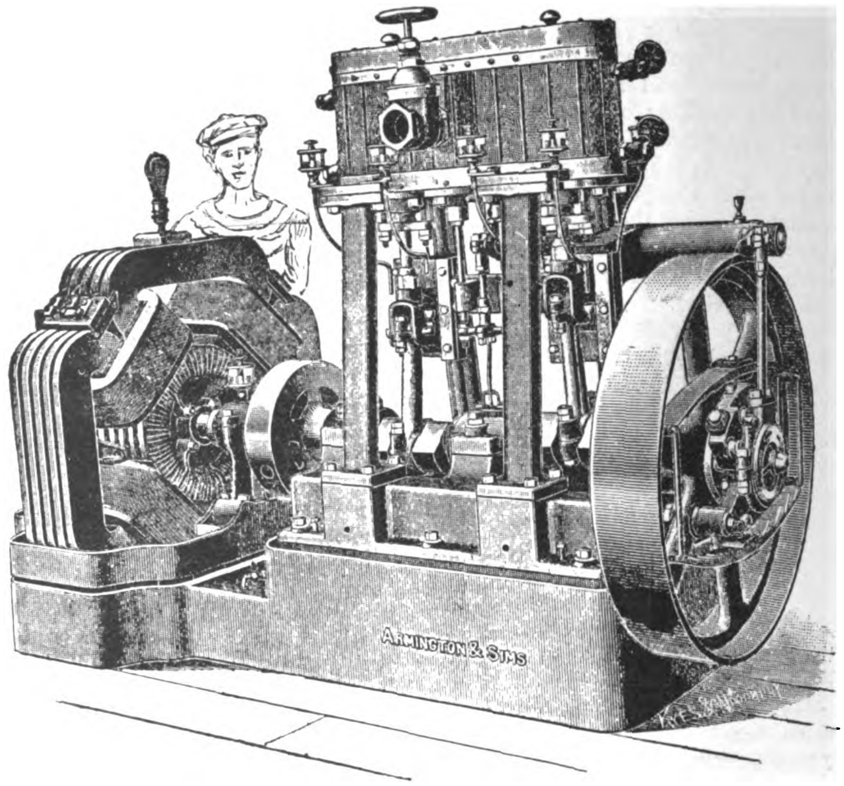


Fig. 7—Generating Plant Used in the Navy.

The carbons are kept separated when the projector is not in use, but as soon as the proper switch is closed they are brought together automatically, then the arc is struck and the feeding of the carbons maintained automatically with extreme nicety.

In this way one or more projectors are electrically controlled, one man only being required, who would be stationed in the conning-tower or some other protected position. By the conning-tower is meant the armored turret in which the commander of the ship is stationed in action. Here he controls the entire maneuvering power of the vessel. Here, by the simple movement of a lever or switch, or the pressing of a button, he controls the engines, moves the helm, fires a broadside, launches a torpedo and works the search lights; moreover, he can at any time communicate, either by speaking tube or telephone, with all the important stations in the ship. The fact that in working the projector it is no longer necessary to place men in positions too much exposed to the enemy's fire, will no doubt render these electrically controlled projectors extremely valuable in future warfare.

Still another method of control admits of using hand power, either at the projector itself or through the intervention of rods extending from the projector to a short distance away, thus enabling the hand power to be applied from a position inboard where the operator need not be exposed. Such an arrangement as this would be represented on board ship by locating the projectors on the berth-deck of a battle-ship so as to be near the waterline. The operator would be protected and the projectors would be rigged out through ports when desired for use; when not in use they would be rigged in and the ports be closed water-tight.

Another improvement has recently been made in projectors by Sautter, Harle et Cie., in which the plain lens is done away with, and the projector is fitted instead with two diverging lenses of such a character as to permit of a variable divergence of the beam. One of the lenses is fixed, the other moveable. In one of the extreme positions (with the 60 c. m. projector) the angle of divergence does not exceed 2°, the beam is then identical with that which the closed projector gives with a simple plain front lens. The illuminated zone, at 1,000 metres distance, has a width of 35 meters. In the other position the dispersion is 20° and the illuminated zone at 1,000 metres is 350 metres wide. The rotation of a wheel moves the lens longitudinally so as to procure the intermediate positions.

Generally speaking, the former extreme position of the diverging lens would be used in searching at long range; and the latter when sweeping rapidly for defence against torpedo boats, when long range is not required, but instead, great divergence and a quick searching beam. The 60 c. m. projector with the lamp taking 75 amperes, and the beam concentrated, should give a range of nearly 3 miles; that is, it should make light objects plainly visible at that distance on dark nights; of course, assuming that there is no fog or mist.

ELECTRIC LIGHTING IN COAL MINES.

The H. C. Frick Coal and Coke Company, of Pittsburgh, Pa., the largest coal operators in the world, have just completed arrangements for the illumination of their mines by electricity, in fact the lighting of two mining plants has already been successfully accomplished. The contract for the work has been awarded to the Westinghouse Electric and Manufacturing Company, under whose supervision the installation of the lighting plants was conducted. The first two mines to be lighted by electricity were the Leisenring No. 1 and Leisenring No. 2. The operation of the lights was begun a few days ago. The results gave complete satisfaction to the Westinghouse and Frick Companies.

Most of the mines are situated in the Connellsville region, in Westmoreland and Cambria counties, Pa., and a number of them are shaft mines, varying in depth from one hundred to nearly one thousand feet. Owing to the accumulation of fire damp and gas in many of these mines the

lighting has always been a very grave problem, because almost every known method of illumination included the danger of fire. This led at last to the adoption of electricity for lighting purposes. The success of the first experiments is causing the abandonment of all other methods of lighting in favor of the electric light.

The Westinghouse company has been one of the first electrical corporations to realize the vastness of this field, and they began to pay attention to the subject of "electricity in mines" several years ago. In consequence they have gained much experience in that branch of the business, and have been very successful in the work undertaken. In many of the mines of Western Pennsylvania, Westinghouse apparatus is in use, and not long ago the company completed an installation at a mine in the iron ore district of Lake Superior.

The Frick Company has adopted the method of lighting each mine independently, and at every mine is installed Westinghouse direct current apparatus of sufficient capacity to light up the mine below and above ground. The lamps are distributed underground throughout the main walks leading to the shaft. In addition, the tipple above ground, the engine house and other surface buildings are lighted by the same plant. The lamps vary in candle power from 16 to 50 c. p. Electric light plants are now being put up at Leisenring No. 3, Trotter and Standard mines—the latter, by the way, is said to be the largest coal mine in the world; but the plants for all the mines will probably not be completed in less than a year.

THE WESTON AUTOMATIC ENGINE.

In these days of electrical engineering more attention to the regulation of steam engines is given than ever before. In fact the requirements of the electrical industry have given an impulse to steam engineering scarcely less important in its results than any since the days of Watt and Stephenson. The engine which a few years ago was considered good enough for all practical purposes would now be cast aside as totally unfitted to the requirements.

Among the new engines which are being received with favor among the electrical fraternity is that herewith illustrated. Fig. 1 gives a perpective view of the Weston Automatic engine and shows at once that it possesses at least one of the prime requisites—compactness. The guides are a fixed portion of the bed, planed therein and accurately scraped. The cross-head shoe is adjustable to allow for wear and a simple adjustment will always leave the engine in correct alignment.

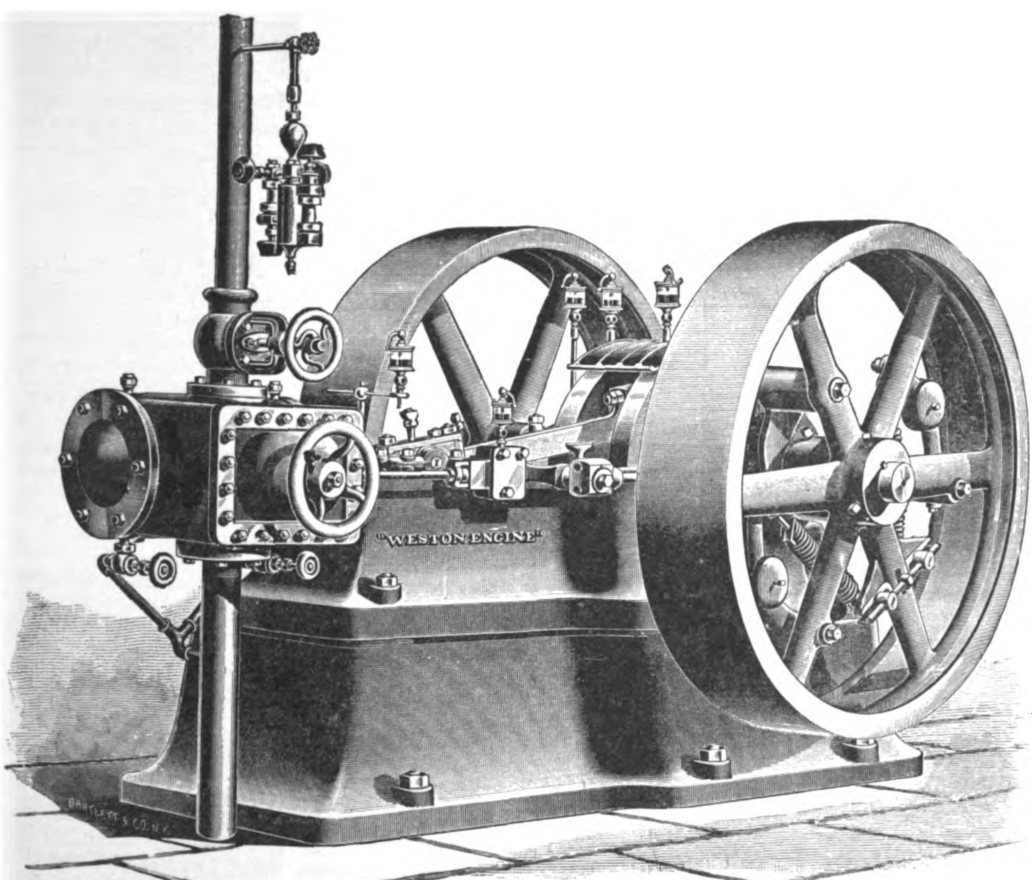


Fig. 1.—Weston Automatic Engine.

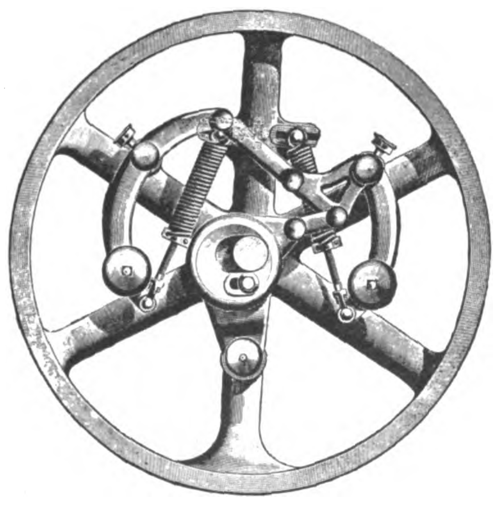


Fig. 2—Weston Automatic Engine.

The valve consists of a single casting pressed upon its seat by an adjustable spring arrangement which counteracts the tendency of the live steam to reduce this pressure. This form of valve will keep tight for a long time, acquiring a high polish and working with but little friction. Wearing down by its own weight does not open a leak, as in the ordinary piston valve, and when leakage does occur it is readily taken up by the adjustable pieces which support the pressure plate.

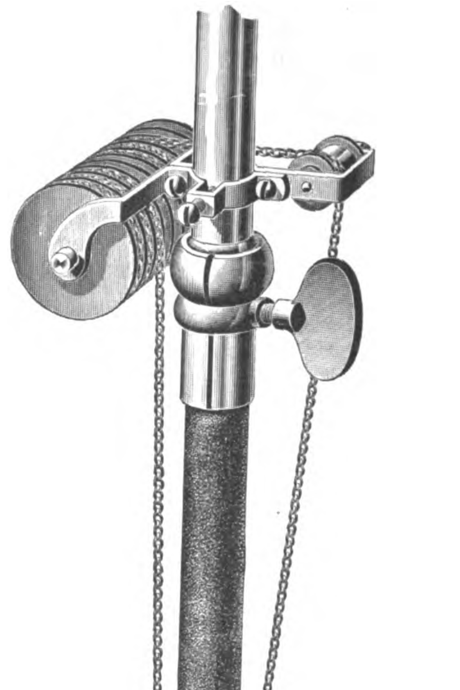
Fig. 2 represents the governor employed on this engine. It belongs to that class of centrifugal governors in which the eccentricity of a regulating cam is decreased by centrifugal force and opposed by centripetally acting springs. A feature of this particular arrangement is that the tension of both restraining springs may be simultaneously and similarly modified by a single right and left handed screw, placed at one side of the shaft. This is an important feature, for in other arrangements it often happens that the lack of proper adjustment of one spring entirely neutralizes the correct adjustment of the other, rendering the resultant adjustment nil or worse. With this device such a contingency cannot arise.

It is claimed for this governor that it will regulate within 2 per cent. from friction to full load under any change in boiler pressure to a point so low that the engine must take steam seven-tenths of the stroke to do the work.

The general agents for the Weston Automatic Engine are Messrs. Julian Scholl & Co., 40 Cortlandt St., New York City.

THE GARLAND CARBON PROTECTOR.

Many expedients have been resorted to to lengthen the hours of service of the arc lamp. The one most usually adopted is to employ two sets of carbons, one of which is not in circuit until the other is consumed. Another is to employ either two positive carbons which alternately go into service with a common negative, or to use two



The Garland Carbon Protector.

flat carbons—one positive and one negative—between the adjacent ends of which the arc passes back and forth until one or the other, or both, are consumed. Still another device is to replace the positive carbon pencil with a slowly rotating carbon disc around the periphery of which the arc travels as the disc revolves. All of these accomplish the desired object by supplying an increased amount of material to meet the consumption due to longer hours.

To quite a different category belongs the device herewith represented, which is based on the principle of lessening the consumption of the carbon. It is well known that a large waste of carbon, which does not in any way contribute to the efficiency of the lamp, is due to the oxidation of the red hot end of the positive carbon by atmospheric oxygen. To prevent this the Interior Conduit

& Insulation Co. are now placing on the market the Garland Carbon Protector, which was exhibited at the Montreal convention.

It consists of a drum, actuated by a spring, upon which are coiled chains that hold up a jacket or collar of refractory material against the bevelled end of the upper carbon, as shown in the cut. By thus surrounding the heated portion, the air is excluded, and waste due to oxidation is orevented.

It is claimed that the life of a carbon is nearly trebled in this way and that the efficiency of the lamp is improved by the increased area of the crater that results from this protection. This company also provides the collar or jacket with a disc of mica which acts as a reflector of the rays that would otherwise be lost to useful purposes.

ANSWERS TO CORRESPONDENTS.

Subscribers to Electricity are invited to make use of this column whenever electrical questions of general interest arise. Where apparatus is concerned, full details should be given.

It will be the aim of Electricity to answer all legitimate queries of an electrical nature, in as clear and untechnical a manner as possible and thus to make this column a friendly guide to those of its readers who may desire such assistance.

Inquiries should be accompanied by the full name of the writer- not necessarily for publication, but for our own information, and should be addressed to the Editor of Electricity.

In Mr. Leonard's formulæ for determining the "Minimum first cost of plant and Maximum Economy of operation in Electrical Transmission of Power" published in your supplement of Sept. 2, where does he get his factor 1000? My interpretation of it is that desiring to figure in kilowatts he reduces his h. p. thereto by dividing by 1000 (assuming 1 kilowatt practically equivalent to 1 h.p.) and then introduces the factor 1000 in his constant to get them back again.

(1.) Will you please explain this? Mr. Leonard also omits from his formulæ, the efficiency of motor.

(2.) Should not this be an important factor in determining the minimum first cost of plant?

J. S. B.

(1.) Mr. Leonard uses the kilowatt as his unit of energy and does not derive it by dividing by 1000 as you suppose. His formulæ which contain the factor referred to are based on the assumption as stated that x volts are used per 1000 feet of transmission. It is not therefore introduced to cancel another factor but is used legitimately.

(2.) The omission of the efficiency of the translating device is perfectly proper, as it is a constant that cannot be affected by any construction of generator or line. The loss due to lack of efficiency would be the same whether high or low potential were used, whether the line were long or short, or whatever the drop on line. An inefficient translating device merely means the generation of so much more energy and Mr. Leonard's formulæ and curves show how this energy can be transmitted to the best advantage.

Will you please state through your paper -

(1.) What is the proper voltage to use to deposit nickel properly?

(2.) What reaction takes place in the Edison Lalande cell?

S. O. N.

(1.) The best results are usually obtained in nickel plating with an electro-motive force of about 2 volts and a density of about 0.02 ampere per square inch of kathode, but in the beginning and until the whole surface is flashed it is best to work with a pressure of 5 volts and a density of 0.1 ampere and then reduce to the former figures.

(2.) The elements in this cell are zinc and cupric oxide and the solution caustic potash. The primary reaction may be represented as follows:

$$2Z_nO+K_2=2Z_n+2KOH+2C_uO=C_{u2}O+H_2O$$

and the secondary reaction,

$$K_2+2H_2O=2KOH+H_2.$$

That is to say, the cupric oxide is reduced to the form of suboxide and the zinc is oxidized with the liberation of metallic potassium. A secondary reaction now sets in at the positive metal, the metallic potassium is set free, at once decomposing the water, forming again caustic potash and liberating hydrogen gas. This secondary reaction is the explanation of the apparent anomaly of the liberation of hydrogen at the positive element.

FROM NEWS CENTERS.

NEW YORK.

New York, Oct. 10.- The *Evening Post* deserves the thanks of the city of New York for its attitude on the question of rapid transit. It may be that the final decision of the Rapid Transit Commission will clear the Commissioners of the suspicion of breach of trust. At the same time it is hard to disassociate this suspicion from such results of their investigations as have from time to time been given to the public; but just now it looks as if another of the flagrant pieces of jobbery by which the administration of the affairs of the city have too often been disgraced is about to be perpetrated. Under these circumstances the *Evening Post* has done well to state the actual conditions of the situation as clearly and as fairly as it did in its editorial columns in the early part of the week. Its three editorials, headed respectively, "What is the matter with the Greathead System," "Singular Silence," and "Is there anything in this for Tammany," ought to be read by every citizen of New York, suggesting as they do, the possibility of abuses that would be tolerated by no other community in the world of corresponding intelligence and prestige.

It has been made clear to the Commission that an underground railway on the Greathead system could be constructed here at an estimated expense of one million dollars a mile, that private capital could be depended upon to raise the entire amount necessary for construction, that the system is no longer in the experimental stage, but has been proved to be an ideal system, the one system in successful operation which overcomes all the most serious obstacles that will be met with in constructing an underground railway here. One by one all the assertions made against it by the advocates of other methods have been disproved. It is no longer attacked in any quarter, but instead of being attacked it is put aside and treated as if it had never existed. The *Evening Post* asks: "Why does not the Commission ask the consulting engineers who have given opinions substantially adverse to the two plans presented by the Commission's engineers, to give opinions also upon the Greathead method?" A road constructed under a Broadway sidewalk would pave the way for an endless amount of jobbery of one kind and another, carrying damages into every vault along its route, disturbing the foundations of buildings, and making necessary a complete tearing up of the street and the building of a new system of underground pipes. This would furnish a rich Tammany harvest. But a road that would disturb no foundations or vaults, and necessitate no purchase of property beyond the comparatively small space needed for the stairways and elevators would be mainly in the hands of the contractors, completely removed from the reach of politicians. "Is it these peculiarities of the Greathead system which prompt the singular silence about it in the Commission and its engineers? If not what are the reasons?" Furthermore, "Why do the engineers of the Rapid Transit Commission ignore a successful system which can be constructed for a million dollars a mile, and revert to a modified form of an unsuccessful one which will cost two and possibly three times that amount?" The city of New York as well as the *Evening Post* would like an answer from Mr. Steinway.

The first elevator to be operated upon the new principle invented by Mr. H. Ward Leonard, was tested on Thursday, and the result was an unqualified success in every particular. The test was made on the elevator in the central station of the Edison Electric Illuminating Company, of Brooklyn. In Mr. Leonard's new system, the operation of the elevator is controlled entirely by the movement of a handle in the elevator car, and the elevator is under perfect control. The smoothness of the motion of the car, both in increasing and decreasing the speed, and in reversing the direction of motion, is surprising to those who are familiar with the peculiar "sinking" sensation experienced in the modern high-speed elevator.

Among the officers who received orders to join the "Yorktown," which has sailed this week on a three-years' trip, is Lieut. Bradley A. Fiske. Lieut. Fiske's name is well known in connection with some of the most important electrical inventions of the day. His duties on the "Yorktown" will be such as could be performed by any officer of equal rank, and why a man of such attainments should be condemned to an exile in which his great value to the country will be virtually lost, especially at a time when electricity is playing such an important part in the development of naval war appliances, is a question which has excited great astonishment and not a little indignation in electrical circles. It is no secret that when called on to report for his three years' term of service at sea, Lieut. Fiske asked to be appointed to the "Baltimore," on which it would have been possible to continue the admirable work which he has been carrying on during his three years' stay on shore. The refusal with which this request was met was made more significant by his appointment to a ship like the "Yorktown." It is hinted that the object of this appointment was to gratify the official jealousy which the success attained here and abroad by Lieut. Fiske's range-finder was calculated to excite. It is possible that more may be heard on this subject.

G. H. G.

MONTREAL.

Montreal, Oct. 7.—The Electrical Convention recently held in Montreal, together with the remarkable exhibition of electrical appliances which was such a prominent feature of it, will long be remembered here as an unprecedented event in showing Montrealers the wonders of electrical science, and especially what progress our neighbors across the line are making in the practical applications of electricity. It has also done a great deal to stimulate the electrical industries of Canada, and has brought more forcibly than pen or word could do before the prominent electrical men of the United States the fact that a grand field is open here in the utilization of many waterfalls and rapids for power purposes which are at present running to waste. We feel honored in having had the convention held here. Thanks to the efforts of Mr. A. J. Corriveau, Prof. Bovey and others, the association chose to visit this city and Montrealers feel sure that the delegates have taken away with them a lasting remembrance of their stay

Canada has profited by many American inventions, indeed in some cases more than have the Americans themselves, for as Mr. Wyman pointed out in his speech at the convention, the Canadians have more efficient telegraph and telephone systems, in proportion to the population, than the United States.

A great deal is being done here in electric lighting and electric power. Numerous stores and private houses are lighted by the incandescent lamp. One of the prettiest and most useful applications of incandescent illumination is in the Queen's Theatre, where the footlights are composed of three rows of lights, respectively red, green and white. The colors are used to heighten the effect of different scenes, as the green for moonlight effects. These lights may be turned down like gas by means of the reactive coil. Quite a number of stores use the electric motor for runing light machinery. Among the different makes of motors in use here may be mentioned the Edison, Thomson-Houston, Sprague, Thomson, Eickemeyer, Crocker-Wheeler and Connecticut. The work these motors are put to ranges all the way from elevators, printing, brass finishing and plate glass grinding, to operating jewelers' lathes and cash railway systems.

Besides the number of plants which supply current for power purposes, there are many private installations, the largest of which, that of Henry Morgan & Co., consists of three generators and one five-horse-power-motor. The generators are two 50-light Thomson-Houston arc dynamos and one 250-light incandescent dynamo of the same make. There are two engines, one of 30 h. p. driving the incandescent dynamo and one of 80 h. p. driving the two arc machines. In the boiler room are three 50 h. p. boilers. One of the special features of this plant is that it is kept scrupulously clean and the engineer, in uniform, is always ready to show and explain the operation of the machines to visitors.

The street lights are run on the Thomson-Houston system, and current is supplied by the Royal Electric Co. The incandescent lights supplied by the Royal Electric Co. are run on the Westinghouse alternating system and current is sold at meter rates. It will readily be seen that although we may be behind many of the more favored cities

of the States, we are doing a good deal which it may be worth while to bring from time to time to the notice of readers of Electricity.

H. F. B.

BOSTON.

Boston, Oct. 10.—A Boston syndicate has made an offer to equip and operate the proposed electric street railway at Derry, N. H.

Work on the new power house for the electric street railway at Lowell, Mass., has just commenced. The main building will be 170 by 130 feet and the steam plant will include five 500 h. p. engines.

At the opening of the new Columbia theatre in this city last Monday evening, the perfect arrangements for lighting the building and for luminous stage effects were much commented upon and worked splendidly. The magnificent switchboard was built by J. P. Cushing and the wiring throughout was the work of Pinkham and Godfrey.

The magnificent terminus of the Midland Railway Co., at St. Pancras, London, is to be lighted throughout by electricity and for that purpose six 50 light arc dynamos have been ordered from the Thomson-Houston International Electric Co., in addition to thirteen 50 light machines and lamps purchased some time ago, by the same corporation.

Heavy shipments of lighting and railway supplies are being made almost every week at the present time, to South America and Australia by the Thomson-Houston International Electric Co.

There is a good prospect that ere long the storage battery road between Danvers and Beverley, Mass., will be equipped with the overhead trolley system.

The Cambridge city council has just adopted the Gethins gravity battery for use in connection with its police alarm signal system and placed a large order for the same.

The order for 500 car motors recently placed by the West End Railway Co. with the Thomson-Houston Electric Co., is taxing the capacity of the great factory at Lynn, as the order comes on top of a rush of work in every department.

Several Boston electrical firms are making arrangements for exhibiting their manufactures at the forthcoming Street Railway Convention in Pittsburgh.

It is reported that a company has been organized in Sioux City, Ia., to manufacture the Bradbury-Sorley storage batteries, which for some time past have been successfully manufactured in Lowell, Mass. Eastern capitalists are largely interested; part of the plant is being built in Lowell. The company is capitalized at $1,000,000, and business will commence as soon as the factory is ready.

There will be a hearing on Oct. 19, before the city council of Quincy, Mass., on the projected electric freight railway.

A very neat and interesting catalogue on "Electricity Applied to Mining Operations," has just been issued by the Thomson-VanDepoele Electric Mining Co.

W. H. K.

ROCHESTER.

Rochester, Sept. 29, 1891.—Little that is new in electrical matters in this city has transpired since your recent publication of the excellent papers read at the Montreal convention and in New York by George H. Redman, Supt. of the Brush Electric Light Co. and John N. Beckley, President of the Rochester Railway Co. The latter company is constantly improving its motive power, adding to its rolling stock and making the general service more useful to the public. Popular education on the subject is gradually reducing the number of accidents which in nearly every case have been caused by personal carelessness on the part of those injured. The company, up to a recent date, had been using nine generators of the Short system. These generators were found to be either too small or otherwise deficient, and the efficiency of the power house is being augmented by the introduction of some of the larger ones of an improved pattern lately brought out by the Short Company. The improvement is already apparent and complete satisfaction is confidently anticipated.

The Railway Company is now operating about sixty miles of line in the streets of Rochester, using nearly sixty motor cars and some forty trailers which are called into service as emergency requires. Two trailers are sometimes attached to one motor car, making a very respectable looking train for street service. Horse cars are still in use on a few lines, but are taken off as rapidly as possible. When they are entirely abandoned and the lines fully equipped with electric power the company will have a total of one hundred motor cars and a corresponding increase in the number of trailers. There is no doubt that the existing lines will in a very short time be so far extended as to necessitate the use of a much greater number of motor cars, as the inhabitants of outlying districts are vigorously clamoring for further extension.

Rochester is also favored with very efficient electric light service, furnished by three companies—Brush, Rochester, and Edison. Each is generously patronized by the citizens as far as its lines extend and all have a share in the illumination of the streets. During the last fiscal year the street lighting required the use (besides gas) of 1143 arc lights and 787 incandescent lamps. The city paid the electric companies, for lighting, something like the following: Brush Electric Light Company, $81,700; Rochester Electric Light Company, $29,000; Edison Electric Light Company, $21,000. Extensive additions have since been made and the figures will be greatly increased during the current year.

Something of interest will soon be shown in the success of the electric railways outside the city, operating in connection with the city lines, two of which are in full operation and one or more others are in contemplation.

G. H. L.

COMMERCIAL PARAGRAPHS.

We have before us a handsomely illustrated catalogue of the Buckeye Engine Company, of Salem, Ohio. In addition to the purely advertising feature, this little pamphlet contains considerable matter of general interest to steam users, which will make a place for it among that unhappily small class of circulars that do not immediately find their way to the waste basket. One of the most interesting features is a series of curves, showing the results of some recent experiments by Prof. Denton to determine the relation of steam consumption to cut-off in a simple, non-condensing, double valve engine.

H. Ward Leonard & Co. report that the subscriptions for "Electrical Intelligence" are coming in freely. Owners of central stations and isolated plants have promptly appreciated the great advantages to be derived by securing trustworthy information at moderate rates. Many supply houses and electrical manufacturing companies are among the subscribers. For special information such as is called for by concerns of the latter description, special rates are quoted.

Messrs. James W. Queen & Co., of Philadelphia, have just issued a new catalogue and price list of Electrical Testing Apparatus and accessories, which is claimed to be the most complete of its kind ever issued in this country. It is a profusely illustrated pamphlet of 124 pages, and covers everything in the electrical testing line demanded by the practical or technical electrician. Especially varied is their list of Magnetic Vane ammeters and voltmeters, hot wire voltmeters, electro-dynamometers, portable galvanometers and testing sets and electric light photometers. The book also contains, among other interesting features, a full page illustration of and directions for using Brackett's Cradle dynamometer, manufactured solely by this firm.

Taylor & Son, of 39 Dey St., New York, are successfully introducing their Taylor primary battery, which is a powerful bichromate cell adapted for running small motors and electric light installations. The E. M. F. of the cell is 1.83 volts, and the internal resistance being very low, a current of 22.5 amperes is obtained on short circuit. Messrs. Taylor & Son have a certificate of a test in which one of their cells gave for ten minutes on short circuit a current of 21.5 amperes, the internal resistance being .077 ohms. This speaks well for the constancy of the battery.

The Great Western Electric Supply Company, sole agents of the Sun Arc Lamp, are receiving many orders for their lamp, and the sales are increasing steadily. The Sun Arc Lamp is especially adapted for use in theatres, central stations, halls, stores, and in many places where the ordinary arc lamp is not desirable. It gives a steady, bright, white light, and for working on direct current incandescent circuits it has no equal in the market. The Great Western Electric Supply Company are also agents for the celebrated K. K. line wire, of which they report very satisfactory sales.

The company has just issued a new railway catalogue, which is one of the most complete of its kind that has ever been issued. Their new lighting catalogue is now out, and is complete in every detail. It will be ready for distribution in a few days.

The Electric Supply Co., of Chicago, is placing a new style dry battery on the market under the name of the Ajax Improved. This battery has been thoroughly tested and found to give as good results as any yet put on the market. The battery is smaller in size but of similar style to other dry cells.

The Shaw Electric Crane Company, of Muskegon, Mich., is building two cranes, each of fifteen tons carrying capacity, for the use of the government at the Brooklyn Navy Yard. They are of the Shaw three-motor type.

Business is brisk with the Walsh Torch Company, 48 W. Adams street, Chicago. The low price and superior make of their goods cause them to be in excellent demand.

The North American Electric Company, of Chicago, has entered into a contract with the Central Electric Company, of Chicago, for the sale of the sole right to manufacture and sell their dry battery, the "Gladiator," in the United States. They are now perfecting an entirely new style of primary battery.

PERSONAL NOTES.

Mr. H. B. Prindle, for several years past, chief of the advertising department of the Thomson-Houston Electric Company, has resigned his position and has gone into business with a gentleman of large experience, under the firm name of H. B. Prindle & Co., Manufacturers' Advertising Agency, with offices at 732 Exchange Building, State street, Boston. Mr. Prindle has enjoyed a wide and varied experience in the advertising field, and will do business with trade journals. Besides a general advertising business, a special feature will be made of preparing trade catalogues of every description. In this work Mr. Prindle has achieved success while with the Thomson-Houston Company. The new firm will represent several leading trade journals. Business began as recently as Thursday, October 1st, and the outlook is reported as promising.

Walter A. Allen, clerk to the Massachusetts State Board of Gas and Electric Commissioners, is back from a two months tour in Europe. Mr Allen speaks in glowing terms of the progress being made in Europe in the use of electric light and power. He spent a week at the Frankfort Electrical Exhibition, also a week in Berlin, which city he considers the best lighted in Europe. Wherever he went he found only the very best work being allowed and used, and is of opinion that American electricians may yet learn much on the other side.

Charles H. Herrick, general manager of the Wright Electrical Engineering Company, Boston, has been appointed superintending engineer of the new electric light plant about to be erected at Haverhill, Mass. He will prepare all plans and have entire charge of the installation of both steam and electric plants.

George F. Curtiss has assumed charge of the general advertising department of the Thomson-Houston Electric Company, in succession to Mr. W. B. Prindle, resigned. Mr. Curtiss has a host of friends and in the discharge of his new duties he is certain speedily to make many more.

Dr. Carter, general manager of the Consolidated Electric Motor Company, New York Life Building, Boston, is making everything ready for introducing the electric road carriage, the advent of which is looked forward to with great interest by the public generally. Its appearance will mark quite an epoch in electrical advancement.

Mr. Fred M. Kimball, so well known in eastern electrical circles, has recently joined the Edison General Electric Company. He is in charge of the introduction of their supply specialties in the New England district. He has offices at 25 Otis street, Boston.

Mr. Thomas J. Fay has recently joined the already large electrical staff of The Crocker-Wheeler Motor Company Mr. Fay has an extensive experience gained by previous connections with the Edison, Thomson-Houston, and other prominent electrical companies. Mr. Fay will have charge of the testing department.

Mr. J. H. Mead, who has so successfully engineered the new Edison electric lighting project and underground conduit system through the municipal boards of Cincinnati, was in Chicago this week. Having completed his task he is looking for other worlds to conquer.

Mr. Schuyler Duryee, who for many years has been the chief clerk of the Patent Office, has resigned. In accepting Mr. Duryee's resignation Commissioner Simonds expressed great regret at the former's determination to sever his connection with the Patent Office.

Mr. C. E. Oldacre, of the Jenney Electric Motor Company, of Indianapolis, is in Chicago on a business trip.

J. B. Wallace, of the firm of Wallace & Sons, Ansonia, Conn., was in the city part of last week.

W. B. Pearson, western agent of the Ball & Wood Engine Company, has gone on an extended business trip through the west.

Henry M. Villard, of the Edison General Electric Company, was in Chicago last week.

The common council of Lockport, N. Y., has granted a charter to the Lockport and Olcott Beach Electric Railroad Company for an electric road to the village of Olcott, under sixteen conditions. The principal conditions are that the road shall be begun within three months from the date of acceptance of the grant, and that it shall be completed by August 1st of next year.

JOTTINGS.

Paris is to have a district messenger service. It will be supplied by the same company which started a year ago in London and which proved successful. The invention of Robert D. Radcliffe is to be used and seven hundred of his special call-boxes are now being made. A trial office is to be opened in the Rue Meyerbeer. Residents of Paris will be able to send messages at far cheaper rates than at present, the charges now ranging from fifty centimes to two francs.

A dispatch from Washington says that Mr. Edward S. Stevens, United States Consul at Pernambuco, Brazil, reports to the Department of State, under date of August 27, that the Western and Brazilian Telegraph Company has just laid a new cable between Santos and Pernambuco—both points on the coast of Brazil. The cable steamer *Silvertown*, of the Silvertown Telegraph Works, London, is now on her way out to lay cables from Pernambuco to the island of Fernando de Noronha, and thence to St. Louis, Senegal, the French colony on the West Coast of Africa. From this point other cables afford communication with Europe, and with the Cape of Good Hope.

Electricity, whatever complaints may be urged against it, at least makes no bad smells in the neighborhood of the places in which it is generated. Gas does. There have been many complaints against the gas companies in New York, and in some parts of that city the gas works are described as menaces to public health. In one case the Board of Health decided that the works were a nuisance, and served a notice on the company ordering it to abate it.

For some little time there has been an active demand for Commercial Cable shares, which advanced eleven per cent., to $122 per share, with the quarterly dividend of 1¾ per cent. "on." The demand for this stock shows that the public appreciates a corporation managed on strictly business principles. Every share of the Commercial Cable Company's stock represents just as many dollars of actual cash paid for the construction of the plant. The increase in the volume of cable traffic growing out of the export demand for wheat, the enormous travel to Europe, the revival of activity in the international markets for securities and the improvement in general business, has directed attention to Commercial Cable shares and created a demand for them and that demand has caused them to advance.

A hale old gentleman from Mississippi has recently been relating some of his reminiscences of New York, Chicago and other places. Early in this century he went from Buffalo to New York by stage and water, paying a fare of $25. The rate of speed at which stages traveled in those days was ten miles an hour. It is somewhat remarkable to think that men are still among us who have witnessed from their very beginning the marvelous changes that modern engineering and electrical science have wrought in our ways of living. When we who are now young have developed into hale old gentlemen, shall we have witnessed progress and changes corresponding to those which this octogenarian has seen. Shall we then see distant objects by electricity as easily as we now hear distant voices, shall we travel to all distances and at all speeds by the aid of the electric motor, and shall we navigate the air with the same unconcern that we now feel in undertaking a voyage on the sea? Truly these are difficult questions to answer. It would be almost as rash to say "We shall not," as to say "We shall."

INCORPORATIONS.

The Goshen Light and Power Company, Goshen, N. Y.; capital stock, $15,000; promoters, J. W. Corwin, William H. Wyker, Robert B. Hick, all of Goshen, N. Y.

The Gregg Electric Cure Company, Chicago, Ill.; capital stock, $50,000; promoters, Arthur W. Underwood, Edwin T. Coman and Chas. Shackleford.

Pittsburgh Underground Electric Construction Company, (incorporated in W. Va.) Pittsburgh, Pa.; capital stock, $300,000; manufacturing, constructing and erecting electric traction roads, laying tracks and road beds, etc.; promoters Chas. D. Robbins, D. J. Rex, J. J. Miller, all of Pittsburgh, Pa.

The Nicholson Electric Hoist Company, Cleveland, Ohio; capital stock, $30,000; promotors, D. A. Dangler, Martyn Bonnell, F. C. Pope, H. D. Coffinberry, H. P. Lillibridge, Ezra Nicholson.

Orne Electric Construction Company, Chicago, Ill.; capital stock, $11,000; to manufacture electric appliances and speaking tubes, and do a general mercantile business; promotors, Edward T. Orne, Wm. E. Duncombe, Wm. N. Wegg.

The Columbus & Johnstown Electric Railway Company, Columbus, Ohio; capital stock, $200,000; promoters, W. Shepard, Felix A. Jacobs, Rufus S. Clark, S. H. Ewing, W. B. Rusler, J. W. Lake.

The Defiance Light and Power Company, Defiance, Ohio; capital stock, $100,000; promoters, E. N. Lewis, C. P. Harley, H. P. Miller, Henry J. Smith, Henry Foez, Orlando Dyarman and R. H. Gleason.

Southern Electric Company, Baltimore, Md.; capital stock, $50,000; to manufacture electrical machinery; promoters, A. Pierre, John Waters, F. W. Schultz.

Anglo-American Gas Control Company, San Francisco, Cal.; capital stock, $200,000; to manufacture, buy, sell, rent, and deal in governors and gas burners, lamps, fixtures and appliances for control and consumption of gas; also to manufacture and sell gas and electric lights, also real estate; promoters, L. A. Kelley, George T. Gaden, S. F. Long, H. L. Tatum, J. J. Bowen, H. A. Williams, J. P. Langhorn, all of San Francisco, Cal.

The Citizens Electric Light and Power Company, Pueblo, Col.; capital stock, $100,000; promoters, John F. Fail, John H. Black, John W. Finlan, all of Pueblo, Col.

ELECTRICAL PATENT RECORD.

Letters Patent Issued Sept. 29, 1891.

TELEGRAPH AND TELEPHONES.

460,109. Telegraphic Transmitting Instrument. Chas. G. Burke, Richmond Hill, N. Y. Application filed June 17, 1890.
The primary object of this invention is to give the transmitting operator perfect control over the length of actual contact for each impulse, so that the character of the impulses may be varied to best meet the stated conditions of a given cable.

460,110. Telegraphic Instrument. Charles G. Burke, Richmond Hill, N. Y. Application filed Dec. 26, 1889. Renewed Feb. 11, 1891.
The instrument consists, essentially, of two coils at approximately right angles suspended or supported in a magnetic field formed by four magnetic poles arranged in the order described, to exert simultaneously upon the coils attractive and repulsive effects co-operating to produce a given movement in one direction of the coils, when the latter are traversed by an electric current.

460,111. Telegraphic Instrument. Charles G. Burke, Richmond Hill, N. Y. Application filed Feb. 11, 1891.
This invention consists in the combination, with two freely suspended coils movable in independent magnetic fields, and bars attached to said coils, of a vibrating contact or recording arm connected by threads to the said bars, and means for adjusting each coil to and from the contact-arm.

460,328. Printing Telegraph. John E. Wright, New York. Application filed Dec. 30, 1890.

460,349. Printing Telegraphic Apparatus. Gilbert A. Cassagnes, Paris, France. Application filed Nov. 28, 1890.

460,457. Printing Telegraph Instrument. John E. Wright, New York, N. Y. Application filed Dec. 31, 1889. Renewed Sept. 5, 1891.

RAILWAYS AND ACCESSORIES.

460,163. Trolley for Electric Railways. Frederic F. Smith, Woburn, Mass. Application filed Dec. 20, 1890.
This invention is designed to prevent the trolley from being thrown off the trolley wire when the car is passing around curves.

460,488. Trolley Switch. Harry L. Pierce, Leomister, Mass. Application filed Oct. 22, 1890.

460,524. Electrical Railway Signaling Apparatus. William F. Z. Desant, New York, N. Y. Application filed Sept. 26, 1890.

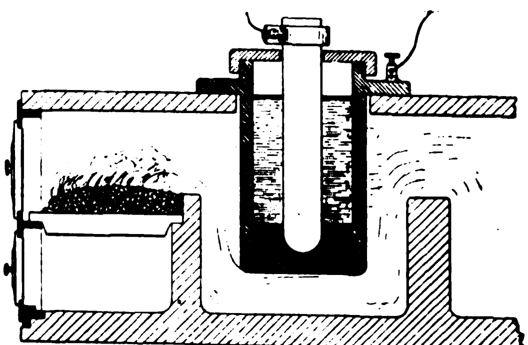
460,525. Electrical Railway Signal. William F. Z. Desant, New York, N. Y. Application filed Sept. 26, 1890.

LAMPS AND ACCESSORIES.

460,178. Hanger for Incandescent Lamps. James A. Matteson, River Point, R. I. Application filed Dec. 24, 1890.

BATTERIES.

460,122. Process of an Apparatus for Generating Electricity. Thomas A. Edison, Menlo Park, N. J. Application filed May 26, 1882.
The process consists in subjecting a body of carbon or carbonaceous material to a high temperature in the presence of an active agent composed of a body of oxides capable of combining with carbon of a high temperature, and a positive element composed of a metal not acted upon by such active agent, but located in contact therewith.



Patent No. 460,122—Apparatus for Generating Electricity.

460,235. Electrode for Secondary Batteries. John B. MacDonald, Chicago, Ill. Application filed Feb. 5, 1891.
The claim reads:
"In a storage battery, a grid for the support of the active material, composed of a metal ribbon having indentations or raised portions upon its surface and bent back and forth upon itself to form the supporting frame."

460,277. Method of Obtaining Fluids for Primary Batteries. Joseph B. Gardner, Nyack, N. Y. Application filed Sept. 15, 1890.

METAL WORKING.

460,354. Apparatus for Electrolytically Separating Metals from Ores. Werner Von Siemens, Berlin, Germany. Application filed June 13, 1890.

460,428. Method of Soldering or Brazing by Electricity. Charles L. Coffin, Detroit, Mich. Application filed April 17, 1890.
The process consists in connecting one or both of the articles to be soldered or brazed with one pole of a generator, connecting the tool to the other pole of the generator, bringing the tool in contact with the solder seam to be soldered or brazed, and passing an electric current through the tool and material while the is maintained in contact with the solder and seam.

CONDUCTORS AND INSULATORS.

460,448. Insulator. Frank A. Ross, Livingston, Mont. Application filed Dec. 16, 1890.

DYNAMOS AND MOTORS.

460,125. Dynamo or Electric Motor. William M. Fi Elizabeth, N.J. Application filed Oct. 7, 1890.

460,245. Switch for Series Dynamo Electric Machine. C R. Arnold, Sharon Hill, Pa. Application filed Nov. 1890.

460,372. Dynamo. William H. Elkins, Cambridge, Ma assignor, by direct and mesne assignments, to American Electric Machinery Company, Portland, Application filed Nov. 28, 1890.

MISCELLANEOUS.

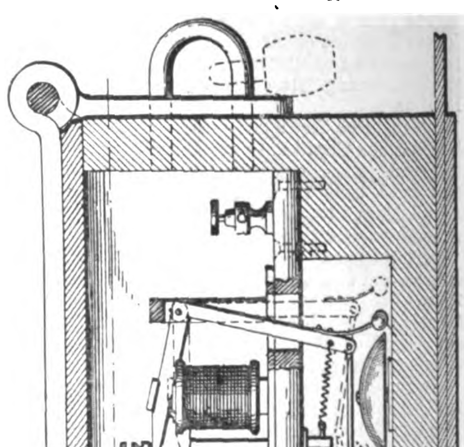
460,140. Electric Safety Catch. John W. Howell, New N. J. Application filed Jan. 6, 1891.

460,199. Circuit Controlling Apparatus. John P. Cush and William J. Kelly, Boston, Mass. Application fi Nov. 6, 1890.
The last claim reads as follows:
"17. In a circuit controlling apparatus or switch-board; a cabinet having a door and provided with a plurality of resistance-heads located therein and having contact members or terminals, contact-arms co-operating therewith, a plurality of pilot-lamps, and independent switches located in said cabinet, and electrical connections joining said pilot-lamps with said switches."

460,287. Electric Alarm. Charles H. Shaffer, Rockford, Ill. Application filed June 20, 1890.
The last claim is presented:
"6. A signal box consisting of suitable gearing, an electro-magnet, an armature preventing the starting of the box and permitting the starting of the box when attracted by the electro-magnet, a portion of the mechanism of the box made movable for freeing the armature from its engagement with the electro-magnet upon the rewinding of the box."

460,289. Lightning Arrester. James J. Wood, Brooklyn, N. Y. Application filed Sept. 25, 1890.

460,364. System of Electrical Distribution. Edwin W. Rice, Jr., Lynn, Mass. Application filed Feb. 13, 1891.
The invention consists in the combination of a multiple series distribution system with an equalizing machine connected in shunt around one of the multiple arc groups and serving as a motor or generator, according as the major load shifts from one side to the other side of the system, said machine being coupled mechanically with the main generator, so as to return and receive power from the same source of energy.



Patent No. 460,391—Electric Lock.

460,391. Electric Lock. William S. Hull, Sheffield, Ala. Application filed Dec. 31, 1890.

460,416. Push Button. John E. White, Syracuse, N. Y. Application filed Aug. 21, 1889. Renewed Aug. 21, 1891.

460,464. Automatic Electric Fire Alarm System. William S. Cook, Moses C. Cook and Albert H. Morrow, South Omaha, Neb. Application filed Oct. 3, 1890.

460,503. Electric Bell. Walter Hay, Chicago, Ill., assignor of one-half to George E. Horn, same place. Application filed May 11, 1891.

460,506. Apparatus for Holding and Sewing Fabrics. Rudolph M. Hunter, Philadelphia, Pa., assignors to the Union Special Sewing Machine Company, of Illinois. Application filed Oct. 13, 1890.

460,514. Electric Crane. William A. Stadelman, Philadelphia, Pa., assignor to the Equitable Engineering and Construction Company, same place. Application filed Mar. 11, 1891.

460,538. Thermal Cut Out. John O. Phillips, New York, N. Y. Application filed Jan. 6, 1891.

460,541. Electric Elevator. Rudolph C. Smith, Yonkers, N. Y., assignor, by mesne assignments, to The National Company of Illinois. Application filed Dec. 31, 1890.
This invention consists of the combination, with a circuit over which a constant current is sent, of an electro motor included in the circuit and connected to operate an elevator, a shunt of high resistance around the motor, and a normally open shunt of lower resistance, including a detent magnet controlling the motor.

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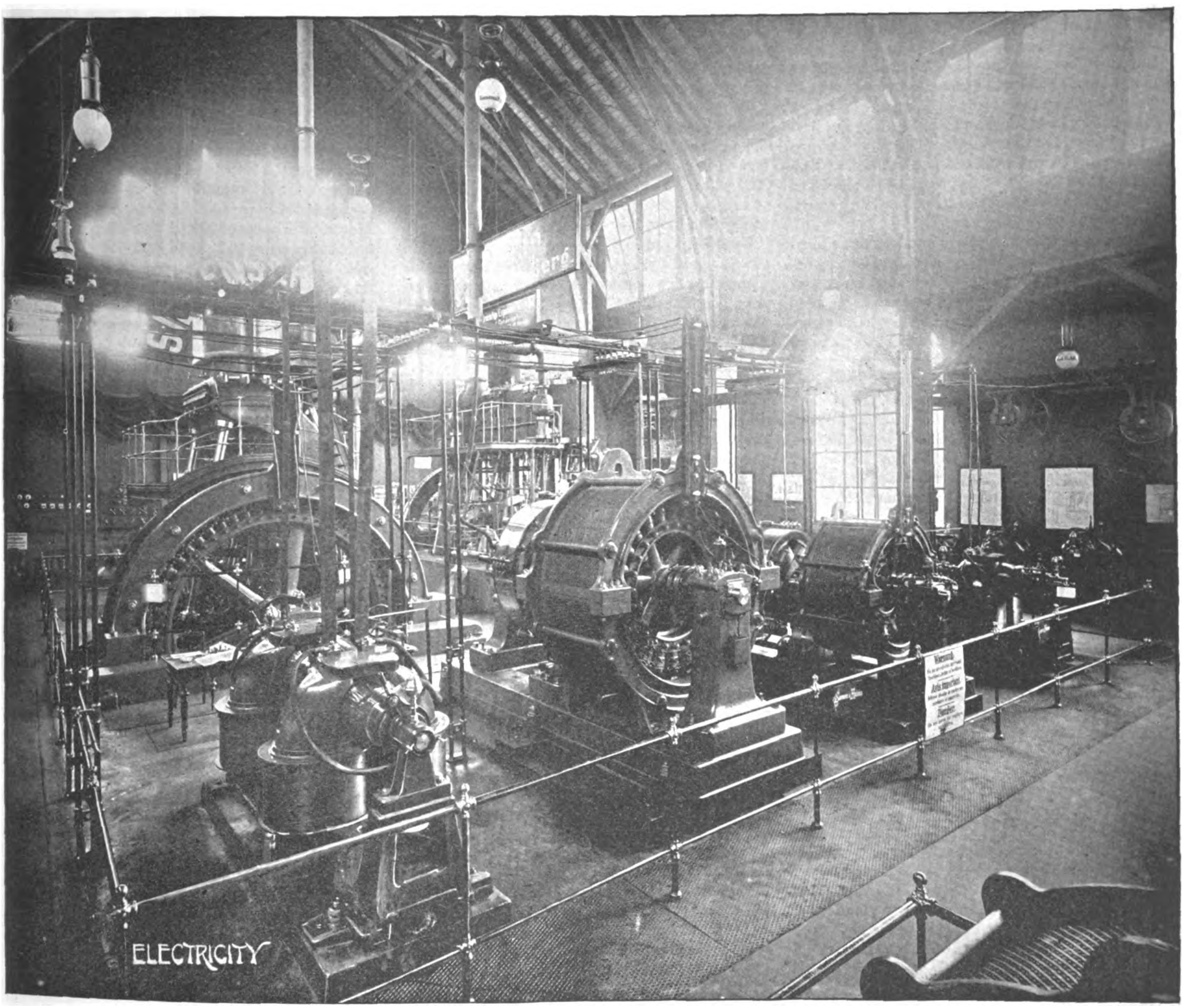

EXHIBIT OF MESSRS. SIEMENS AND HALSKE AT THE FRANKFORT ELECTRICAL EXHIBITION.

(See page 176.)

DIRECT CURRENT-ALTERNATING CURRENT TRANSFORMERS.

BY FRANK C. PERKINS.

Sometimes it is very desirable to use accumulators in combination with alternating current stations and as it is impossible to charge them with an alternating current, the combination of an alternating machine and a continuous current machine is used. This machine is called a Gleichstrom-Wechselstrom Transformator, or Wechselstrom-Gleichstrom Transformator, according as the current supplied is continuous or alternating. The two armatures are mounted on a common shaft and in this way the surplus power of the engine can be used to operate the transformer for delivering a continuous current for charging storage batteries. Vice versa, the storage batteries may supply a direct current to the transformer and an alternating current be obtained.

The machine shown in the center of the frontispiece is a transformer of this type with a capacity of 150 kilowatts, and is used for charging the batteries. An alternating current is delivered to the machine at 2,000 volts and a direct current is supplied to the accumulators at 150 volts.

The Gleichstrom-Gleichstrom Transformer is used for transforming high pressure continuous current to low pressure continuous current, or vice versa. This transformer is represented at the left in the foreground of the view. It is used for transforming a current from the storage battery plant at 150 volts to one of 300 volts pressure for use on the overhead electric railway of Siemens and Halske, running from the Exposition to the Opernplatz. The capacity of this transformer is 60 kilowatts.

There is also on exhibition an alternating current transformer with a ratio of 1 to 10, transforming 2,000 volts to 20,000 volts for use in experiments with high tension currents. A battery of 400 incandescent lamps connected in series is used in this work. The current at 2,000 volts is supplied from the large alternating machine of Siemens and Halske, which is seen in the background of the view. It is coupled direct to a double-expansion vertical engine built by Maschinen Fabrik Buckan of Magdeburg. At 100 revolutions the engine develops 450 h.p. The rotating field magnets of this alternator are excited by current from a separate generator connected direct to a 60 h.p. vertical engine.

The continuous current machine in the background of the view, to the right, has a capacity of 600 kilowatts at 100 revolutions. It is connected directly to a triple-expansion engine of the Marine type built by G. Kuhn, of Stuttgart-Berg. The dynamo is a ten-pole machine and has an armature of the Gramme type over 3 meters in diameter. It delivers current at 150 volts and is used for charging a large plant of accumulators, lighting lamps at the exposition, and for driving stationary motors and electric railway motors.

THE WORLD'S CONGRESS OF ELECTRICIANS OF 1893.*

BY ELISHA GRAY, PH.D., LL.D.

From time immemorial it has been the habit of men to assemble in congress, to deliberate upon all sorts of important subjects. The first Electrical Congress of which there is any mention, is recorded in the Book of Job; but this could scarcely be called an Electrical Congress, for all sorts of scientific conundrums were propounded to Job, who was one of the delegates. Among others were the following:

"Who hath divided a watercourse for the overflowing of the waters, or a *way* for the lightnings of thunder?"

And again, "Canst thou send lightnings that they may go and say unto thee—here we are?"

It is not recorded that any satisfactory answers were given to these questions, although Job was considered a wise man in his day and generation. It is very evident that lightning rods were not in vogue in those days; for not even the presence of Omnipotence, Who, we are told, spoke from a whirlwind, would have prevented the enterprising "agent" from exhibiting his doubled and twisted compound lightning conductors to the convention when the first question was propounded.

Notwithstanding all these years of discussion as to when, how and by whom the telephone was invented, it is very certain that it was subsequent to the meeting of this scientific congress; for otherwise, could not Job when asked the second question, "Canst thou send lightnings that they may go and say unto thee here we are," have answered:

"Certainly, we can send lightnings; and make them say, 'Hello, here we are,' and say it the vernacular."

Since the first electrical congress there have been many held, but perhaps the most important and that most fruitful in results, met in Paris in 1881. The benefits to electrical engineering, and to the great army of inventors, teachers, and workers in the lines of electrical progress, growing out of this congress, would be difficult to estimate.

Ten years have passed since the Paris meeting and they have been years of unwonted activity. Where thousands were invested in electrical enterprises ten years ago, millions are now employed. And yet, we are only stepping over the threshold of the door that leads to a vast unexplored region in the domain of electrical science.

Over fifty years ago there lived and taught a certain professor of physics. One day he explained to his class the experiments of Dr. Franklin with his kite, by which he established the identity of lightning and frictional electricity. At the close of his lecture he said to his class: "Young men, you were born too late to witness the development of this great science." If the shades of the departed are allowed to visit this earth and know what is going on, we can easily imagine the prolonged state of astonishment that our good professor has been in, during the years of his sojourn in the land of shadows, at what some of his pupils have lived to see.

It is eminently fitting that at suitable times and on suitable occasions, men in all departments of science and industry, should come together for interchange of thought and the discussion of subjects that have to do with the great activities of life- practical and intellectual. What more fitting time to hold a series of congresses than during the great World's Columbian Exposition of 1893?

In pursuance of this object the World's Congress auxiliary of the World's Columbian Exposition has been organized, under the support of the exposition corporation, and has been recognized and approved by the government of the United States. Under this organization, local committees have been appointed to organize a series of congresses. Among others, a committee in part to organize a World's Electrical Congress has been appointed. The movement, as yet, is in a formative stage, and much thought must be given to it before a programme can be formulated. An advisory council must be appointed from the most eminent electricians of this and other countries. Some one, or more than one, must visit and confer with the noted men of the world, and no stone should be left unturned to make the Electrical Congress of 1893 the most important that the world has ever seen; not only in point of numbers, but in the eminent character of the men who attend, and the excellence and great importance of the work done.

While the hardest part of the work of organization must necessarily fall upon the local committee, we expect much from the advisory council, especially that portion of it residing in the United States. The fact that the great exposition of 1893 happens to be held in Chicago is an incident over which we have no control. But this fact makes Chicago the place, *par excellence*, for the assembling of the proposed Electrical Congress. The representatives of the world's best thought and best work, will be centred here. The congress will meet under the shadow of the greatest palace of electricity that the world has ever seen. In it will be found science applied, great thoughts translated into machines for the service of man.

To make the most of such an enterprise, all petty jealousies between cities, states and nations must be dropped and all must work as one common brotherhood for one common cause. Men must be selected on account of their fitness for the work assigned them, and for no other reason. Science and art know no east, no west, no north, no south. They belong to the brotherhood of man, however widely scattered they may be.

When a detailed programme has been systematically formulated by the properly constituted authorities—which will not be done until the most eminent minds on the subject have been consulted—we invite and expect the most hearty co-operation from all men and societies that are interested in electrical progress.

Before the present movement has been set on foot under the auspices of the government of the United States, through the exposition authorities, several electric associations (notably, the Chicago Electric Club, the National Electric Light Association and the American Institute of Electrical Engineers), had started a movement for a congress to be held in 1893. If the congress were to be held under the auspices of *any society*, undoubtedly the American Institute of Electrical Engineers would be the best selection in this country. As it is *now*, it remains for the officers of the World's Congress Auxiliary to suitably recognize the good work done by these associations, and for the associations to give us the benefit of the work already done by them together with their hearty co-operation in the future.

The general outline of the congress will probably be as follows: It should be divided into sections according to the various interests represented. First, there should be a section devoted to the more purely scientific phases of the subject. This section should be composed of the most eminent scientific men in this and foreign countries. The standards that were adopted ten years ago will have had twelve years of trial by the time the congress assembles. It may be that other units should be added to those already adopted, or that better definitions may be given to some of those already in use. Papers should be read by different individuals, relating to the different theoretical and scientific phases of the subject.

Other sections should be organized in the various interests of applied electricity, the number of which will be hereafter determined.

In order to give all a chance to see and hear the great men of the world, all of the sections should meet together on stated occasions, forming one grand general congress, to listen to papers and discussions by the most eminent electrical men of the world.

It is suggested that all of the regularly organized electrical associations should hold their meetings in Chicago in 1893. Suitable assembly halls will be provided for these various congresses and association meetings. The congresses to be held under the auspices of the auxiliary department of the exposition, will begin at the opening of the exposition and continue to its close; so that one will not interfere with the other. The time of

* A paper read before the Chicago Electric Club, Oct. 19, 1891.

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Announcement. With this issue a change is announced in the editorial management of ELECTRICITY, although the present editor has actually occupied the position for the past month. Mr. Irving Washington, business manager, has resigned his position on the paper, his resignation taking effect at the end of the present week.

* * *

The 1893 World's Electrical Congress. The paper read by Prof. Elisha Gray at the Chicago Electric club last Monday evening, which we print in full in this issue, is a most suggestive outline of the possibilities to be accomplished by the World's Electrical Congress of 1893. Unquestionably there is an immense amount of work to be done that the preliminary arrangements may be satisfactorily defined and a comprehensive programme drawn up. We feel confident, however, that all American electricians will heartily respond to Prof. Gray's stirring appeal, and both as individual workers and as members or officers of scientific societies co-operate in making the Congress a grand success. With proper organization there is time enough to ensure the electrical gathering in 1893 being the scientific event of the century.

* * *

A plea for the Series System. The telegraph, the telephone and the arc light are, as a general rule, all operated on series circuits. In fact, where large distances have to be covered the series method of distribution has, for obvious reasons, always been adopted. This method was first in the field, but on account of mechanical and electrical difficulties has made but little progress. Mr. Perry, in his article on the Future of Electric Railways, points out some of these difficulties and thinks they are bound to be overcome so that this system will again assume the importance it deserves. Certainly a wide field for investigation, which has of late years been almost untouched, is here presented in a clear and forcible manner.

* * *

The Primary Battery in History. A curious little note, which tells of an early application of electric traction, is printed this week. However romantic may be the account of the electric cart, which was operated at the very low expense of less than one cent per bath-chair-mile, it is evident that the primary battery inventor was active even in those prehistoric days. "We hear" says this ingenuous reporter of the middle ages "that the increase of power is due to the discovery of a new combination of the elements; that this is the secret of the moving power; and that the battery is to be the subject of a patent." This has a familiar sound and almost the same phrases have been echoing through the pages of electrical literature, without much further result, for the past fifteen or twenty years.

* * *

Alternating Continuous Transformers. Our special correspondent at Frankfort contributes to this issue an interesting description of the exhibit of Messrs. Siemens and Halske. Electricians in this country will be interested in the various types of mechanical transformers described. Continuous current transformers have been used by some of the central station companies in London with fairly satisfactory results. Alternating-continuous current transformers, to use the German name, are, however, somewhat of a new departure. There is no doubt that the adoption of these machines would greatly increase the flexibility of alternating current plants. But our correspondent gives none of the details of cost and efficiency which a practical man requires before he is willing to pay much attention to a new type of machine.

* * *

Electrical Aestheticism. A description that we print this week of a central station which its designers and owners consider a model plant of its kind, contains a reference to the efforts of those in charge to beautify the machinery and decorate the principal department of the station, so as to give those employed in running it a proper pride in their work. We think the point an excellent one and it is one that is too often overlooked. It costs very little more when installing electrical apparatus of any kind to pay a little attention to the "setting," in the artistic sense of the word, and the outlay is well repaid in the end for various reasons. Not only will the workers perform their duties better if their surroundings are pleasant to the senses, but material will be better taken care of if it is made to look its best to begin with and a proper standard of appearance kept up. Electrical æstheticism is worth paying attention to.

* * *

Electricity and the Census. We have received from Mr. Allen R. Foote a copy of a letter addressed to Secretary Noble by Mr. Robert Porter. This letter, which will be found in this issue, will be read with interest by all concerned, either directly or indirectly, in the electrical industries. It sets forth very clearly the reasons which proved the inadequacy of the appropriation made to carry out the collection of electrical data for the census returns, and practically endorses the recommendation of the National Electric Light Association, that a further appropriation be made by Congress to allow of the work begun being completed in a satisfactory manner. In common with all who are wholly identified with electrical progress, we earnestly trust that Congress will see fit to grant the appropriations necessary for the proper representation of the electrical industries in the census returns. We are glad to note that Mr. Porter refers in complimentary terms to the manner in which Mr. Foote has performed his duties as special agent and to his qualifications for the position.

* * *

Non-technical Executives. Some remarks which we made in these columns last week, touching on certain weak points in the electrical industry in general, are curiously enough most emphatically confirmed by Mr. Porter. He says: "While those engaged in various branches of the electrical industries were entirely willing to supply the information called for, they frankly acknowledged that they did not possess the technical knowledge incident thereto, and hence none but experts could secure the information in any other way save by a personal visit to each plant." It would profit little to dilate on this curious feature of electrical development, but it is worth mentioning merely to show that the views we expressed last week are confirmed by actual experience in a manner which admits of no contradiction. From this one would be led to suppose that, generally speaking, business men cannot be electricians, and that electricians cannot be business men. We prefer to think that this conclusion is an unfair one, especially the latter half of it. The subject is one of such general interest that although we have not the space to devote to a further discussion at present, we shall return to it in the near future.

* * *

The value of the Search Light. In this issue is concluded the admirable article by Lieut. Hutchins, on "Projectors." The general review which Lieut. Hutchins makes of the various military and peaceful applications of the search light is a most studious and comprehensive piece of work. Of the value and importance of the projector in naval warfare there can be no question, although it has recently been pointed out by naval critics and emphasized by unfortunate experience that a too free use of the powerful beam is likely to produce results disastrous to the users and to their supporters. It is evident that the search light can be most effectively employed in military operations on land as well as at sea, and touching on this subject, some curious results of "strategic electric lighting" are described. British military authorities are keenly alive to the value of the search light in land operations and have had practical experience which points to the necessity of a field electric light plant as part of the equipment of an army. It will be remembered that in the first issue of ELECTRICITY we drew attention to the importance of ocean steamers being provided with powerful projectors. That article was widely copied and the suggestion indorsed by the daily press, and it will be noticed that Lieut. Hutchins lays special stress on this point.

the meeting of the electrical congress is not fully determined, but due notice will be given at a later date.

A little reflection will convince any friend of electrical progress that no place or time for holding such a congress as is proposed, could be more auspicious than Chicago in 1893.

The result of such a gathering of great minds, all centred upon one general subject, cannot be too highly estimated. Finally: Success will be assured from the beginning if all our interested friends act harmoniously and are actuated by one common desire that the *best thing shall be done*, without regard to geographical boundaries or local prejudices.

Discussion.—A prolonged discussion took place after the reading of Prof. Gray's paper. Among the speakers were Col. Clowry, Prof. Barrett, Messrs. Sunny, Dryenforth, Day, Tripp, Shaw and Parker. It must be confessed that several of the speakers strayed somewhat from the point under discussion—the World's Electrical Congress of 1893. Mr. Sunny enlarged on some of the points made by Prof. Gray, and said that there was plenty for the Congress to do in acting upon the matters left over from the Paris Congress, such as the adoption of the watt and the joule, in naming the units that have since been proposed, the gauss, the weber and the henry, and in a final determination of the ohm. Mr. Shaw, as a manufacturer, said that although a previous speaker thought the time short for the work to be done, he felt that the time was so long before the exhibition would be opened that manufacturers ran the risk of the apparatus which they had in view when applying for space would become obsolete before 1893. Mr. Parker, in a most eloquent speech, pointed out that owing to the supremacy which America enjoys in the practical development of industrial electricity, the electrical section would be the most interesting and attractive feature of the Exposition. He held, therefore, that the directors of the Exposition should give priority to the electrical department in all arrangements and should do all in their power to render the Electrical Congress a successful gathering.

THE ELECTRICAL CENSUS RETURNS.

LETTER FROM COMMISSIONER PORTER TO SECRETARY NOBLE.

Washington, D. C., Oct. 5, 1891.

Sir:—I have the honor to acknowledge receipt of your communication of date Sept. 30, requesting me to "reconsider and report upon the inclosed memorial of the National Electric Light Association, sent down by the President," together with your reference of a letter from the Honorable, the Postmaster-General, of date, Oct. 1, touching the same subject, and respectfully submit the following information in relation thereto:

The wonderful advancement of the electrical science, both in invention and successful application, occurring during the last decade, induced this office, upon the solicitation of the National Electric Light Association and other interested parties, to institute preliminary inquiry thereinto, being the first investigation of that subject ever made under federal authority, or by any other government. For this purpose, Mr. Allen R. Foote, an electrical expert and author of national reputation, and a most worthy gentleman, was strongly indorsed by the National Electric Light Association, and by a large number of representative firms and public men. He was appointed Dec. 4, 1889, and has been indefatigable in his efforts to push the work to completion.

It is proper to observe, however, that when it was decided to investigate this subject, it was not contemplated that the scope of the inquiry would extend beyond certain defined limits, common to the special branches of productive industry. Subsequently, however, upon consultation with gentlemen interested in this subject, the schedules were so broadened as to cover details that were regarded as necessary to properly present the condition of these important industries, and the questions contained in the schedules were approved by the National Association, as well as by electrical men generally.

Electrical science being a newly applied industry, the cost of the investigation could not possibly be estimated with accuracy, nor even approximately, but as it progressed, the expense, present and prospective, was found to be so great that I felt unwilling to divert funds from other branches of census work to employ them in behalf of an industry, however important, which would inevitably entail larger outlay than was anticipated. To meet this emergency, a bill was introduced at the last congress providing an appropriation of $50,000, to be expended specifically in making inquiry into the electrical art and industries, but it failed to pass. It then became imperative to secure, if possible, the necessary returns by correspondence, and although every effort has been made, the project has not yielded satisfactory results. The reason for this failure is peculiar and anomalous. While those engaged in the various branches of electrical industries were entirely willing to supply information called for, they frankly admitted that they did not possess the technical knowledge incident thereto, and therefore none but experts could secure the information in any other way save by personal visit to each plant. Hence it was determined to postpone further investigation until the Fifty-second Congress should assemble, thus temporarily relieving the Census Office of further expense in the premises, and accordingly an order was issued to that effect.

Upon the representations, however, of Special Agent Foote, concerning the non-advisability of completely suspending the work, this order has been countermanded. The inquiry will henceforth be conducted by correspondence, so far as that may be found practicable, with the aid of one special agent in the field.

It should be borne in mind, however, that similar action of temporary suspension was taken with reference to all other special branches of productive industry. It was also found that the outlay required to complete the collection, examination and tabulation of manufacturing returns was so large as to render it impracticable to assign to this branch a sufficient amount from the funds remaining in hand to complete any part of the statistics of manufactures. Hence I have been impelled to apply the remainder of the appropriation to the completion of the population statistics and such other branches of census investigation as could, without great expense, be immediately concluded, and meantime to defer publishing the statistics of manufactures, simply maintaining the current work of that division until after the meeting of Congress, and additional appropriation shall have been secured.

No one appreciates more than myself the high importance and value of this investigation into the electrical art and industries in connection with the presentation of census statistics comprising all other productive industries of the country.

Prior to entering upon the electrical inquiry, the Division of Transportation had been charged with the collection of statistics relating to telegraphs, telephones, and electrical railroads, and the Division of Vital Statistics trenched somewhat upon the electric lighting and surgical domain. These inquiries have been eliminated from other divisions, and committed as an entirety to the Division of Manufactures, having been assigned to the branch of special investigation into the electrical industries, thus materially adding to the cost as contemplated for the original inquiry.

In order that some idea may be formed of the great extent and value of the work now involved in the census inquiry concerning electrical industries, it is important to state that there have been prepared for the collection of statistics for the Eleventh Census, nineteen schedules and as many supplements, covering the following subjects:

1. Schedules for preliminary Information.
2. Schedule for Educational Institutions giving a course in Electrical Engineering.
3. Electric Light and Power Stations.
4. Manufacturers of Electrical Apparatus and Supplies.
5. Isolated Electric Light and Power Plants.
6. Commercial Telegraph Companies.
7. Commercial Telephone Companies.
8. Steamboat Electric Light and Power Plants.
9. Municipal Electric Light and Power Stations.
10. Uses of Electricity in Medicine and Surgery, Manufacturers of Apparatus.
11. Uses of Electricity in Medicine and Surgery, Medical Colleges.
12. Uses of Electricity in Medicine and Surgery. Hospitals.
13. Uses of Electricity in Medicine and Surgery, Physicians.
14. Municipal Fire Alarm Telegraphs.
15. Municipal Police Patrol Telegraphs.
16. District Messenger Companies.
17. Uses of Electricity in Mining.
18. Telegraph Lines used by Steam Railroad Companies.
19. Electric Street Railroads.

There have also been issued 50 different forms of printed letters of inquiry and transmittal, besides numerous typewritten and form letters. In addition to the statistics provided for by these schedules, statistics are to be collected by letter and by personal application, on the following subjects:

1. Scientific Electrical Instruments.
2. Ocean Telegraphs.
3. Electrical Distribution of Time.
4. Uses of Electricity by the United States Government.
5. Electrical Tabulating Machines and Registers.
6. Electroplating.
7. Electro-Metallurgy.
8. Electric Welding.
9. Special Uses of Electricity by Steam Railroads, such as:
   (a) Telegraphing from Moving Trains.
   (b) Special uses of the Telephone.
   (c) Block and Road Crossing Signals.
   (d) Electric Head Lights.
   (e) Electric Train Brakes.
   (f) Electric Train Lighting.
   (g) Uses of Electric Motors for Operating Draw-Bridges, Turn-tables, Traveling Cranes, Hoists, and Telpherage.
10. Electrical Patents issued by the United States.

All advices received by me, concerning the inquiries comprised in the schedules prepared under the direction of Special Agent Foote, express the conviction that they are skilfully drawn and thoroughly adapted to that purpose. It is also indicated that those employed in the development of electrical invention and industry will interest themselves therein, and cheerfully make response thereto an indication of supreme importance to the Census Office.

The memorial and other papers I herewith return.

Very respectfully,
(Signed.) Robert P. Porter,
Superintendent of Census.

The Hon. John W. Noble,
Secretary of Interior.

AN EARLY APPLICATION OF ELECTRIC TRACTION.

A correspondent sends us the following curious extract from an old volume of the newspaper in which the article appeared nearly fifty years ago.

"We are informed that a distance of 57 miles has been run on the common road, in a bath-chair by electro-magnetic power, in one hour and a half; and further that the applier comes over daily from St. Alban's to the Bank of England in the said chair in half an hour, at an expense of sixpence. The model of an electro-magnetic engine, which has been exhibiting at the Adelaide Gallery for some time, is an instance of ingenious mechanical arrangement, whereby contact is

broken and renewed, the poles reversed, etc.; and from its performances gave great promise of practical powers on a large scale. The battery employed is the nitric acid, or Grove's battery. Of the invention that has done the great feat and established the successful application of this wonderful agent, we know little more than its success. We hear that the increase of power is due to the discovery of a new combination of elements; that this is the secret of the moving power; and that the battery is to be the subject of a patent."

From *The Guardian*, Columbia, Tennessee, January 9, 1842.

This interesting piece of news must have been taken by *The Guardian* from some London paper, probably of romantic or at any rate over credulous nature. Merely as a curiosity, however, the electro-magnetic bath-chair is worth enquiring into and we are writing our London correspondent to try to discover the original source of the description.

CURRENT ELECTRICAL TOPICS.

The recent terrible railway accident in Spain was due to the blunder of a telegraph operator; he confused the similar names of two different stations, causing the station master to allow a train to proceed when he should have stopped it. The railway telegraph service in Spain is maintained in an even worse state of inefficiency than that of this country, where many accidents are caused much in the same manner. The unfortunate operator in this case was a boy of eighteen, and was what is called an *aspirante*, that is, he aspired to become an operator and worked without salary until his superiors should see fit to appoint him an operator of the third class, which now of course they will not do. The real criminals responsible for these disasters are those who place untrained men in positions of the gravest responsibility.

The New York *Herald* thinks that the Rapid Transit commissioners who have kept the inhabitants of the metropolis in suspense for so long, "are beginning to realize that there is a limit to public patience." The public has certainly been wonderfully patient and it is not surprising to find that the procrastination of the commission has aroused a feeling of resentment at last. One of the associations of residents of the upper part of New York has appointed a committee to call on Mr. Edison with a request to test his new electric motor on some of the west side surface roads.

At the International Exhibition to be held in Madrid next year, to celebrate the anniversary of the famous voyage of Christopher Columbus (who in Spain was known as Cristobal Colon), it is intended to have an electrical section. This exhibition is to be open from September 12 to December 31.

ELECTRICAL CENSUS BLANKS.

We have received from Mr. Allen R. Foote, special census agent, copies of the blank for "Report of Street Lighting by Electric Arc Lamps." In this blank spaces are given for entering very complete information on arc lighting, the main headings under which data are required being, Number of Lamps, Current Used, Contract, Circuits, Power and Rate per Unit. This last head has five sub-divisions, and one might be inclined to think that the refinement has been carried a little too far, as, for instance, when in addition to the rate "per lamp-mile hour," the rate "per kilowatt-mile hour" is demanded.

OBITUARY NOTICE.

We regret to state that Mr. Charles F. Heinrichs died in Chicago on Tuesday of last week. Mr. Heinrichs was well known in electrical circles, especially in New York, through his work in electric lighting. He was about fifty years of age.

HISTORICAL ELECTRICAL APPARATUS FOR THE WORLD'S FAIR.

The Department of Electricity of the World's Columbian Exposition is endeavoring to secure among the exhibits in the electrical section a complete collection of historical apparatus.

Chief Barrett's assistant, Mr. E. E. Keller, has the matter in hand and has opened correspondwith those supposed to have in their possession apparatus of this kind. The intention is to secure apparatus used by the physicists of bygone times in their researches, and to combine this in an exhibit showing the progress of the science from as early a date as posible. There are, of course, many valuable and interesting relics of this nature in existence in Europe and America, and the problem is to get the owners of such apparatus to place it at the disposal of the Department of Electricity. Mr. Keller is fully aware that this is no easy task to accomplish and he is anxious that all persons having a knowledge of the existence of any historical electrical apparatus should communicate with him and aid him in his investigations.

PROJECTORS.

BY HAMILTON HUTCHINS, U. S. N.

PART III.

PRACTICAL VALUE OF THE SEARCH LIGHT.

As soon as it was realized that the large ironclads were defenceless against torpedo attack, the European powers began experiments with the search light, and its adoption by the navies of the world is owing to the great development of torpedo warfare. One navy after another made practical tests with it, and in every case it has been shown conclusively that it would be simply impossible for a torpedo boat, in clear weather, to approach undetected near to a man-of-war aboard which the light was well used. As will be shown later, the light is of service in many ways, but torpedo defence is its principal use. Generally speaking, the search light is considered an indispensable part of the equipment of all large vessels and is strictly a weapon of offence or defence; but great judgment is necessary as to when it should be used. For instance, the torpedo boat being low in the water, her horizon is extremely limited, and more than once cruisers by keeping their search lights going at times when the torpedo boats have merely been reconnoitring, have needlessly disclosed their position to the attackers. On the other hand, when expecting an attack by torpedo boats, the cruiser's search lights must be used constantly, as they form the best means of defence. The torpedo boats, when blinded by the search light, are powerless to manœuvre, to say nothing of the exposure to the deadly fire of the machine guns of the cruiser. At least four search lights of say 60 c.m. diameter of projector, are considered necessary for the equipment of every large man-of-war. In the Italian navy, however, two or three times this number are supplied, but of a smaller size. The "Lepanto," one of the largest Italian ironclads, carries fourteen 16" projectors.

The utility of the electric search light for torpedo boat work was said to be very thoroughly tested during the Spanish manœuvres in 1889, and the result of these tests was its abolition from the equipment of torpedo boats in the Spanish navy. It was found to be valueless in a seaway on account of the motion of the boat, which renders it almost impossible to focus the light upon any object and maintain it there; moreover, it seems at such a time only to indicate the position of a torpedo boat to the enemy. At all times the light was so near the water that it illuminated a large expanse of the surface, the confused reflection making objects in the illuminated area almost indistinguishable, and it was found to be quite impossible to see anything beyond. It must be remembered, however, that for navigation purposes, for instance when reconnoitring the approaches to a harbor, the search light would be of value even on a torpedo boat; so that the fact of it not being invariably required should not prevent it from being included in the equipment of the boat. It might also be useful in cases where two torpedo boats were manœuvering conjointly, one using the light and the other taking advantage of the adjoining dark space to make an offensive movement. It may be here noted that it is the present custom in foreign navies to provide torpedo boats with search lights.

The projectors carried by a man-of-war should be placed as near the water line as possible, in order that the diverging beam of light shall be far-reaching; care should be taken at the same time that the position be not so low as to make the light useless in a seaway. Their position should also be influenced by that of the guns. They must be placed with due regard to the concussion on firing the heavy guns; also, they must not interfere with the firing of the secondary batteries. Just at the critical time when a torpedo boat is discovered by the search light, then are the rapid-fire and machine guns wanted to repel torpedo boats, so that it would not do to allow the proximity of the beam to blind a man sighting one of these guns.

As an instance of the difficulty in picking up dark objects with the search light compared to objects of light color, it was considered necessary in some of the torpedo launches where the crew were exposed, to have everything about the launch painted black, even to the men's faces.

Besides torpedo defence, there are numerous other applications of the electric search light on boardship. At the bombardment of Alexandria by the British squadron, the search lights of the latter not only illuminated the harbor, but they also served to keep the British constantly informed of the nightly progress of the Egyptians while erecting their batteries. When engaging at night the the search light is of value in directing the fire of the battery. It is also useful in chasing and keeping fleets or convoys together, and in reconnoitring a coast. It is useful in preventing collisions, in entering harbors, passing through narrow channels or going alongside a wharf. Even when coaling ship or taking in stores, it enables the work to be done as rapidly at night as by day. It is also useful for signalling, as instanced in the first part of this article. Many other useful applications follow as emergencies arise. Some time ago one of the ships of the British flying squadron shifted her foretopmast at night by the electric light of another of the squadron which lay near her; and it is but a few months ago that the search lights of the British squadron anchored in Gibraltar Bay were the means of saving hundreds of people from a sinking merchant steamer, who otherwise would have drowned.*

In foggy or misty weather, the power of the search light is seriously crippled, for it has little or no penetration, merely producing a general brightening of the fog. Its use under such circumstances in time of war would only seem to indicate the position of the ship to the enemy.

MILITARY OPERATIONS.

In time of war the projector has an important use as a portable light for military operations. Its special development for this purpose is due in a great measure to the Royal Engineers of the British Army; and many valuable points can be gained from a lecture on the subject delivered by Major R. L. Hippisley, R. E. The main results of the experiments may be summed up as follows: For a portable light for field operations, a special equipment is necessary—one which cannot be sat-

*This application of the search light was illustrated in the frontispiece of ELECTRICITY for July 22.—ED.

isfactorily extemporised on the eve of war, and several units of which ought to be kept in store ready for emergency. An electric light apparatus portable enough to follow an army in the field can be used for a variety of purposes.

The most obvious use is during a siege. We may take it for granted that every first class fortress will soon be provided with powerful search lights. In England, preparations are being made on a large scale for the introduction of the most brilliant search lights for the southern defences, both sea and land, to be at the disposal of the artillery stationed in the forts. We may therefore take for granted that a besieging army will find any permanent fortress against which it may be engaged, in possession of electric lights to aid in keeping a watch on the night operations conducted against it. The siege of a fortified place would, therefore, no longer be the comparatively simple operation of constructing works at night and firing from them during the day. The construction of the ordinary siege works in the manner hitherto adopted would not be possible, except at an enormous sacrifice of life. But this disadvantage on the part of the attackers can be greatly offset by the employment on their part of electric search lights; for not only has it been shown that when the atmosphere is at all laden with smoke or mist, the range of the light is seriously curtailed, but it has also been proved that the penetrating power of the light can be diminished to a large extent by the employment by the other side of another beam crossing the first at an angle. It seems that the illuminated space at the intersection of the two beams presents a screen, more or less opaque according to the amount of smoke or mist with which the atmosphere is charged.

An electric beam can therefore be used as a screen, behind which operations can be conducted in secret. The applicability of this use of the light in the attack of a fortress is obvious. In order to produce this screening effect, it is only necessary that a powerful search light should be placed in front of the flank of the ground to be hidden, so that its beam may be projected in front of it. It is better to throw the beam diagonally across the front, rather than to make it traverse straight across, because its obscuring power is much greater when so disposed, and also because it contributes to disconcert the enemy's fire by the dazzling effect upon those working the guns. The projector used should be capable of throwing a very condensed beam, and care should be taken to avoid any stray rays illuminating the ground which is intended to be hidden. The light can also be used with great effect to lay the guns afterwards placed in these siege works. The firing can then be carried on at night with almost as great accuracy as during the day. The apparatus for use in sieges must be the most powerful obtainable. For attacking a position other than a fortress, or for reconnoitring, the employment of search lights would be hazardous.

DEFENCE.

Here there is nothing to lose and everything to gain. It has been conclusively shown that the light can be placed so as not only to reveal nothing of the defenders' position and movements, but so that it actually affords additional security to them by the depth of the obscurity which it casts over objects in its immediate vicinity, which are out of the reach of the beam. The apparatus is extremely difficult to hit. This is not only on account of difficulty in estimating the range, even with tolerable accuracy, but also because, without special appliances, it is almost impossible to aim at the light. As an instance of the deceptive effects of distance, it may be remarked that if the beam be directed on the ground so as to illuminate a patch of ground between the defenders and the enemy, but sufficiently far from the latter, it appears to any one looking at the projector from a distance as if the lights were situated immediately over the patch of illuminated ground; and if the projector be elevated or depressed slightly, so as to cause the illuminated patch to advance or recede, it seems as if the projector itself were advancing or receding. Owing to this illusion it is almost an impossibility, without cross-bearings, to determine the range of the light, if it be kept constantly on the move, as it would have to be when searching for an enemy in front; and even if kept steadily fixed, his difficulty in estimating the range is very great. Besides, bullets can frequently pass through the mirror without doing any damage to the light.

With regard to the difficulty of aiming, it is of course impossible to look at the direct light on account of its blinding effect, and therefore it is impossible to aim at it in the ordinary way. In the English experiments the guns were aimed by the shadows of the sights on a piece of white paper held behind the backsight. The light from the projector was thrown upon a plane mirror mounted on a pole. The mirror could be traversed or elevated from a safe position behind a parapet where the projector was placed. The mirror was a thin sheet of silvered copper stretched on a frame, and though pierced occasionally by bullets, the reflected light from it was as strong as ever. It will be very seldom that an extemporised shelter cannot be made for the projector. The light is thus worked under cover, all that is exposed being the thin stretched metal mirror mounted on a pole, duplicates of which could be easily and cheaply provided in case of accidents, and could be quickly substituted for the broken one.

Many experiments have been tried in England with search lights of various degrees of portability with a view to developing an apparatus for field operations, but the portable generating plant was considered to be too heavy and noisy. Gen. Sir Evelyn Wood said that he found the electric light of inestimable value in Egypt, and that he never went to sleep at night without throwing the light in the direction of the enemy to see if he were moving. For the defence of a port, recent manœuvres have demonstrated that the simplest and most effective adjunct is the search light in sufficient number to illuminate the entire approach.

MERCHANT MARINE.

Many of the naval applications of the search light cause it to serve obviously a very useful purpose on board both sea-going and inland steamers. On our Great Lakes nearly all steamers are now supplied with it; and in fact everywhere the best vessels are not complete without one or more projectors, and once provided with them should keep them always ready for instant use. Last year, of a total of 3389 vessels that passed through the Suez Canal, as many as 2836 are reported to have employed the electric light in order to make the passage by night. The following table shows the progress that has been made in diminishing the average time of transit:

	1887 H.M.	1888 H.M.	1889 H.M.	1890 H.M.
Average time of transit - -	33.58	31.15	25.50	24.06
" " with electric light -		21.26	22.30	22.09
Shortest time - - - - -	14.45	14.55	14.45	14.15

We have seen that the search light can be utilised for transmitting signals by the Morse code, and the beam of light projected against the clouds can be seen many miles away. Another and more recent application of the light for signalling purposes is on board the Providence line of steamers on Long Island Sound. It is brought into play during foggy weather, the beam from the Huntington search being thrown directly upwards. In these waters the fogs are said to be as a rule not more than 200 feet in height, so that the light once having penetrated this layer reaches the cloud above, its glow being then thrown to an indefinite distance and seen by other vessels, themselves enveloped in fog. In practice the light is flashed perpendicularly simultaneously with the blowing of the fog whistle.

To sum up the practical value of the search light, the evidence is clear that it is by far the most important application of electricity afloat. The incandescent light is a source of convenience and comfort, it gives an effective means of lighting places that would otherwise be inaccessible, it gives immunity from the danger of fire when properly installed, and the attendance required is less than with oil lamps. These are its principal advantages. But the search light is, to a man-of-war, a necessity as a weapon; and, moreover, in addition to its many other uses, it can sometimes serve a far nobler purpose—that of saving life.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

Comparing the amount of space already applied for and the amount that the department chiefs have to distribute among those expecting to make exhibits, floor space will be at a premium before the World's Fair is ready to be opened. A method has just been adopted in the arrangement of the electricity building that may furnish a solution for the chief of this department. Plans are to be drawn up by the Construction Department, locating the restaurant, lavatories, cloak rooms and offices for the consideration of Chief Barrett and his assistant. A number of these conveniences will undoubtedly be placed in the galleries or upper story. It is the intention of the directors of the Exposition to take good care of the inner man, and for that reason they have set apart in each of the buildings a large amount of space for restaurants and cafes. In the manufacturers' building nearly 40,000 square feet of floor space has been set apart for restaurants, and it is supposed that about the same amount of space will be given to that purpose in the electricity building. Naturally, each chief objects to taking his exhibits into the galleries. They say that visitors will not climb up stairs when there are more exhibits on the ground floor than they can examine. By locating the restaurants up stairs, however, the galleries will become just as valuable for exhibitors as the ground floor. This has been done in two of the buildings, and may be done in the electricity building.

Chief Burnham has been authorised to award the contract for furnishing elevators for the Administration Building to the Crane Elevator Company, of Chicago, for the sum of $15,740. The contract calls for three electric elevators.

Arrangements have at last been made by Traffic Manager Jaycox with nearly all of the railroads in the United States. This will be interesting news to the electrical manufacturing companies, especially those engaged in the manufacture of heavy machinery.

Agreements have been made by 269 roads to return, free of charge, exhibits sent over their lines to the Exposition. Half rates in each direction on exhibits have been granted by twenty-five lines, and fourteen railway companies have agreed to transport exhibits free in each direction.

Foreign exhibitors will also be interested in the news that the Atlantic Transport Company, operating a line of steamers between London and New York, has agreed to carry exhibits from London to either New York, Philadelphia or Baltimore free of charge, except the actual expense of loading and unloading. This generous proposition makes it possible for European exhibitors to have their displays brought to the American seaboard practically free of charge.

One of the novel attractions at the Exposition will be the Moorish palace, which will contain a pile of gold worth $1,000,000. This immense

amount of money will be protected by armed guards, and as an extra precaution a fire and burglar proof vault will be constructed directly below. The doors of the vault will be controlled by an electrical closing apparatus so arranged that if an attempt should be made to rob the palace any one of the guards could press a button and the entire pile be lowered into the vault. The doors will be locked by electricity.

A strike among the laborers has somewhat delayed the work on the electricity building this week. The trouble was caused by the contractors reducing the wages of the foremen to forty cents an hour, and the discharging of a number of men without cause. It is thought that the trouble will be settled in a short time, as there are a number of unemployed men in the city who would willingly accept the places of the strikers.

ELECTRICITY VS. GAS.

Mr. W. H Preece, F. R. S., in an address delivered before the Incorporated Association of Municipal and County Engineers, London, spoke of the electric light as not being merely the light of luxury but as "the poor man's lamp."

He stated that he had just concluded an exhaustive investigation of the subject and had come to the conclusion that where the output of electricity was constant and continuous it could be produced more cheaply than an equivalent of gas.

In large cities gas has the advantage in that the products resulting from its manufacture have a large commercial value and defray to a great extent the cost of production.

Mr. Preece said: "When we came to Gibralter and Malta, where I went to see whether it was possible to use electric light instead of gas, and where there is no market for residuals, it required no difficulty on my part to say that it was possible to produce electricity cheaper than gas."

The same condition practically exists everywhere outside of cities of considerable size, for in the smaller places, although there may be a ready market for the residuals, the latter are not saved, for the expense of putting them into marketable shape where but small quantities are handled would be greater than the outcome. It is for this reason that many of the smaller towns, which, before the advent of electricity, remained in total darkness, or at best were fitfully illuminated by oil, are now most brilliantly lighted with both arc and incandescent lamps.

There seems to be no present prospect of lessening the cost of electricity by the utilization of the by-products of its manufacture, for in this case they are only those of the fire beneath the boiler, and it has not yet been found economical to use the waste gases going up the chimney any farther than to extract to the last economical point the extra heat which they contain, but great progress can be and is being made in increasing the earning capacity of electrical plants by extending the hours of working.

Where electricity is used for lighting solely, the generating plant is idle for a majority of the twenty-four hours, or at best is working far below its most economical rate. By the application of electricity to motors for power purposes, the hours of activity may be extended throughout the day time—more than doubling the earning capacity of the plant, and by the use of accumulators or storage batteries, a smaller plant may be employed at its maximum and therefore most economical rate to store up during the hours of minimum demand the energy required during those of maximum demand.

In Europe the employment of secondary batteries in conjunction with central lighting and power stations has become very general and their more extended adoption in this country in the near future is looked for. This seems the most practicable means at present of reducing the cost of the electric light and making it in reality "the poor man's lamp."

ELECTRIC LAUNCHES.

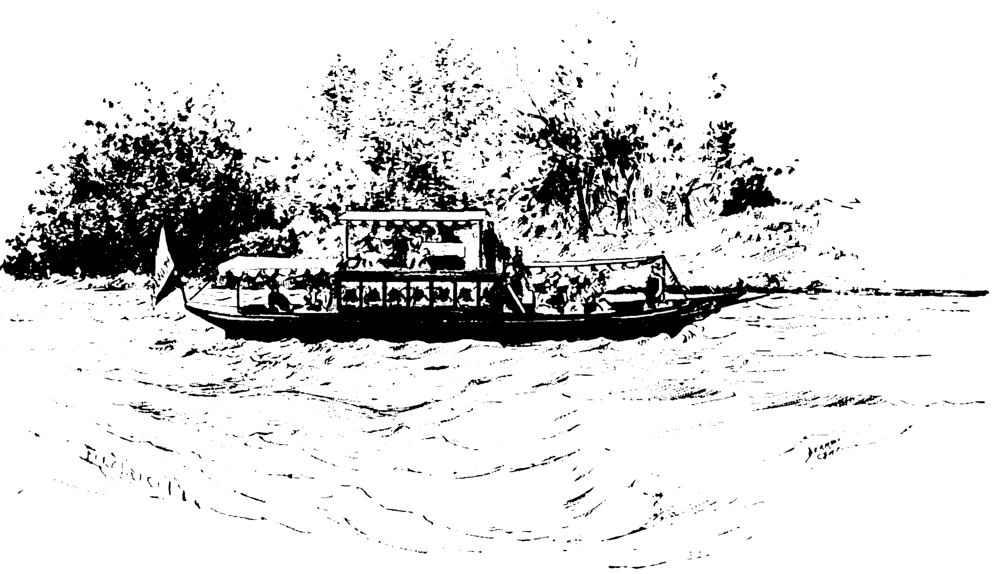
Although in the application of electric power to street railways America has been more active and has made greater progress than all other countries combined, yet in electrically propelled boats little or nothing has been done. For some reason or other electric launches have not "caught on" in this country. One or two have been built and tried, but although successful from their builders' point of view they have been coldly received by the general public and have allowed to quickly drop into oblivion. This is all the more remarkable because abroad, and especially in England, electric launches are in high favor. Some time ago they made their appearance on the Thames, and so popular has this method of river travel become that a large flotilla is in commission every summer, charging stations being moored to the banks at different points along the river for supplying current to the storage batteries by which the launches are operated.

The many advantages which the electric launch offers in comparison with the steam or naphtha launch have led the British government to adopt boats of this kind for use in the dockyards, and an electric pinnace with accommodation for upwards of forty men was recently handed over to the Admiralty by Messrs. Woodhouse and Rawson, the well-known English electrical engineers.

Among the good features of an electric launch may be mentioned the absence of all machinery, except the unobtrusive motor; the occupants of the boat are freed from the annoyances of smoke, dirt, heat and smell, which are always more or less present in steam and naphtha launches. There is much more space for passenger accommodation, as the motor takes up no room that could be used for other purposes and the battery is stowed away under the seats. No trained engineer is required to run the boat, as the movements of the motor are controlled by a simple switch, which can be manipulated just as easily and quickly as any of the pulls and levers now used for transmitting signals between the helmsman and the engineer.

An electric launch such as that shown in our illustration is about forty feet long, six and one-half feet beam, and draws slightly over two feet of water. It can accommodate over forty passengers. The motor is of 3½ h.p., and will give a speed of from six to eight miles an hour with the boat fully laden.

It is to be hoped that some of our street railway and electric power companies who have generating stations near rivers or lakes will see their way to experiment with electric launches; they could do so very economically, as no separate charging station need be established, and once properly introduced electric launches would quickly become familiar craft on our rivers and lakes. At electrical exhibitions they are always a popular feature and we hope that at the World's Fair there will be a whole fleet of them in operation.



Electric Launch.

THE FUTURE OF ELECTRIC RAILWAYS.

BY NELSON W. PERRY, E. M.

Since the successful substitution of the electric motor for the car horse, the tendency has been ever to extend the routes to distances which had hitherto, for commercial or other reasons, been considered impracticable. Street car routes that a few years ago were considered long, have already under the impetus of the electric motor, been extended to double and sometimes treble the original distance. As a new discovery in science but extends the horizon of our view, these further extensions of street car routes suggest the supplanting of the steam locomotive by the electric motor for inter-urban communication. In very many cases, where at first a single generating station was amply sufficient for the distances reached, the extensions of the routes have rendered necessary the construction of additional plants to supply the more distant points. Since these additional plants are not only expensive in first cost, but in operation, each requiring a force sufficient or nearly sufficient to attend to all the dynamos were they concentrated at a single central station, the desirability of centralization on economic grounds is very apparent. But how is this to be accomplished? With the usual voltage employed, two miles is about the limit to which cars can be successfully operated, even though large and heavy feeder wires be employed to obviate excessive drop.

There seem to be two answers to this question - first, by an increase of potential to say 1,000 volts, and second, by the adoption of the series system. We are not speaking of the present, but of the future. We are well aware that with our present knowledge, the series system is impracticable, partly because of the fact that as heretofore attempted, the disturbances on a circuit are cumulative, *viz*: If anything happens to one car, the irregularity of the current caused thereby is visited upon every other car on the circuit; or in other words, every car suffers all the disturbances caused by every other car, until they multiply to such an extent as to be unbearable. The climax comes when the trolley of one car leaves its wire,

which means the total disability of the entire circuit.

But the experience was the same in the development of the arc light. When one lamp flickered, all flickered, and when one was extinguished all went out. It was considered quite an achievement when Mr. Brush succeeded in operating three arc lights in series on a single circuit, but that stage has already been reached in series traction. At the same stage in both lines of experimentation, the disability of one device became the disability of all, its sins or faults being visited, as the Bible tells us they should be, unto the third and fourth generation.

Mr. Brush overcame this difficulty by means of his automatic cut-out, and now, with the addition of other refinements, it is customary to put fifty, sixty, seventy, and even more lamps on a single circuit and each may flicker at its own sweet will; there is no reason that all should wink because one winks, and the fact is that they usually do not. The perfected arc light of to-day is almost, if not quite, as independent of its neighbors on the same circuit as though it had a separate wire of its own. Is it too much to expect that a second Brush may arise and do for the series electric road what Mr. Charles F. Brush accomplished for the arc light? It may not require a second Brush, perhaps the same one who has already done so much for series distribution may crown his labors with this other much to be desired achievement.

But it is suggested that the problem of providing an automatic cut-out for a traveling device is quite different from that concerned with the stationary arc light. Quite true, but still we are of those who believe that it will and must be accomplished. There are other difficulties, and many of them serious enough, that must be overcome before series electric traction can be a success.

The overhead structure must necessarily be divided into sections, each consisting of two wires, so that the car may run between them and in series. Such a thing as a single trolley series road seems now improbable of achievement, but as experience in Cincinnati has demonstrated, double trolleys are not objectionable on constant potential circuits. They are vastly less so where the current is constant.

The division of the wire into sections is a positive advantage, as thereby the road is provided with a most perfect automatic block system, thus reducing the possibility of collisions to a minimum. Collisions, it is true, are not likely to occur in our cities where the speed is necessarily limited, but as distances increase and inter-urban electrical communication, permitting of and requiring more rapid transit, becomes more general, this feature attains to prime importance.

In the most successful attempts to employ constant current for street car propulsion, it has been found necessary, in order to provide for turnouts, in the case of a single track road to wire the route throughout its whole length as though it contained double tracks; one pair of wires being used by cars going in one direction, and the other pair by cars coming in the other direction, and this though there might be but a single turnout not more than thirty or forty feet long. A forked or Y-shaped road could not be operated, nor could cars belonging to separate systems, or those operated even by separate dynamos run on each others' tracks without breaking both circuits, unless each carried its own wires.

The switches connecting the various sections were mechanical and operated by the trolley as it passed, and therefore necessarily suspended on the trolley wires themselves, where they partook of the unavoidable vibration of the overhead structure, besides being exposed to the elements. They were required to be strong and were therefore somewhat bulky. They had to fit tightly, else they would burn out, and if they happened to fit too snugly the trolley failed to operate them; in that case the circuit was broken and all cars on the line were left without current. Their arrangement was such that they were thrown in opposite directions by alternate cars; therefore if it was desired to add to or take off cars from the route, it had to be done in pairs or in even numbers, else the circuit would be again broken. To take off a single car or an odd number it was necessary to change the shifting peg on the trolley mast of every remaining car.

We mention these objections not in disparagement of the system in question, but to indicate some of the difficulties that must be overcome, the failure to do which caused the abandonment of what was the most painstaking attempt up to the present time to solve the series electric railway problem.

But the question arises, what compensating advantages are to be obtained by overcoming these seemingly insuperable difficulties? In the first place there is cheapness in first cost. For the same output in watts, both the constant current dynamo and motor are smaller, and for high potentials by far more economical. The equipment of the station too, is simplified to a high degree the dynamo with its regulator, an ammeter and voltmeter and a single switch, being all that is required and smaller wires may usually be employed.

In operating expenses there are many advantages, among which may be mentioned the following: Since the current is constant there is no overheating of the conductors and therefore the burning-out of fields and armatures from excessive current is unknown.

The size of conductor once being determined it is always equally economical, whether it carries a maximum or minimum amount of energy to a short distance or to a long distance. In what contrast to this is the constant potential practice. In the latter, if the conductors be economically proportioned to carry a given amount of energy to a given distance, they are uneconomical: 1st, when a less amount is carried, because of the too great proportional interest on the investment. 2nd, when more than that amount is carried, because of the too great proportional loss of power in transmission. The size of the conductor is also not economical when the distance of transmission, which is always varying, either exceeds or falls short of that for which the wire was calculated.

In series distribution, that bugbear of constant potential circuits, *viz.*: drop in potential, is unknown, and given amounts of energy may be more economically transmitted to great distances than in any other known way. The economy is particularly marked where the quantity of energy and the distance to which it is transmitted are variable, which is pre-eminently the case in railway work.

Another economical feature of series running must not be overlooked, *viz.*: that the motor connections may be suddenly reversed while the car is at its highest speed, without liability to damage of any kind. Where constant potential currents are used, such a proceeding would almost inevitably result in the destruction of the motor.

On a series road, the brushes may not only be reversed with impunity, but it is an absolute advantage in many cases to reverse them, for by so doing the motor is converted into a dynamo, driven by the momentum of the car, and the energy thus absorbed is thrown on the line for use elsewhere, while the car is brought to a standstill by electrical means.

A series motor car, in descending a grade, becomes therefore a second generator in series with the one at the power station, and the energy thus consumed in braking the car goes to the relief of the driving engine instead of being converted into heat on the wheels and track, as is the case where the car is checked by the mechanical means necessary in other cases. Thus a descending car, or one whose momentum is being checked, helps another car to ascend a grade or to start from rest just as truly as though the two were connected by cable, and this addition to the electromotive force of the line continues to the last turn of the wheels. This feature is not one possible in theory only, but has been amply demonstrated by Prof. S. H. Short, on the South Broadway line in St. Louis, and on the Northfleet railway in England. In the latter case, a writer on the subject stated it was even possible to drive the generating dynamo as a motor, and to turn the engine back against the steam by thus reversing the motor on a descending grade. This, of course, was an extreme case, and indicates a curious proportioning of dynamo to motor, but involves no absurdity from an abstract point of view. Surely such an economy as the utilization of the brake power of the car is one not to be weighed lightly. But even for stationary motors, authorities all agree that where large amounts of energy are to be transmitted over long distances, the constant current method is by far more economical than the constant potential method of distribution.

Several papers have been published showing the estimated relative advantages of electricity and steam for long lines. In one of the papers the line chosen was one of the roads connecting Cincinnati and Chicago. A constant potential current was assumed, and the distance between generating stations twenty miles. Under these conditions it was calculated that electricity and steam would be about equal on the score of economy.

If twenty miles between stations were permissible with constant potential currents, forty miles would certainly be allowable were constant current to be employed. This would reduce the number of stations and, therefore, the operating force required, to just half, and this economy alone would throw the balance heavily on the side of electric propulsion. It is very clear to my mind that whatever may be the future method adopted for shorter lines, if the steam locomotive is ever to be supplanted by the electric motor, it must be accomplished by the series or constant current method.

BOOK REVIEW.

Hints to Power Users. By Robert Grimshaw, M. E. Cassell Publishing Company, New York. Price $1.00.

This is a little book of 147 pages, its object being to give "in plain, every-day English, a series of memoranda, showing my readers, not only the principal sources of loss, danger and inconvenience in power-using, but the means of preventing the same." The object of the book so far is certainly praiseworthy, but another motive is revealed by the closing lines of the preface, which runs thus—"I should be very glad to have power-users all over the country consult me in detail at any time as to designs and plants for new power-plants, or improvements in old ones."

From this we are not led to expect much of value in the text, nor are we agreeably disappointed. Mr. Grimshaw partially fulfills his promise of indicating "the principal sources of loss, danger and inconvenience in power using," but "the means for preventing the same" are either wanting or are in many cases where they are given, entirely absurd. For instance, in regard to boiler explosions he gives as the chief cause, that of weakness and the remedy, to make them stronger. The second most prolific cause of explosions is due, according to the author, to sticking of the safety valves. He says they probably always will stick, and the remedy is to so construct your boiler that when it does explode on this account it will only "just split in some place or other where there is not much steam or water" and where it will do no damage.

The third cause of explosions is ascribed to low

water, and Mr. Grimshaw's remedy is "as for this, about the only thing that we can do is to take the same precaution that we do about the safety-valve sticking—make the boiler so that, whatever happens it cannot explode violently and generally, but will *just split somewhere in a quiet, inoffensive, harmless way.*" (The italics are ours.)

The greater part of the book is on a par with the passages quoted, and we scarcely think it can adequately fulfill its mission with power users.

JOTTINGS.

The City Council of Providence, R. I., is about to grant a franchise to various local corporations for the use of the streets. The franchises will be exclusive for a period not exceeding 25 years, and the companies will pay to the city two per cent. of their gross earnings. The electrical companies interested are the Narragansett Electric Lighting Co., the Union Railway Co. and the Providence Telephone Co.

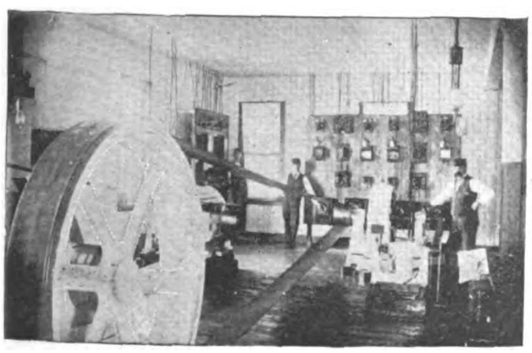
The report of the Western Union Telegraph Company, for the year ending June 30, showed gross earnings of $23,034,326; operating expenses, $16,428,741; leaving the net earnings. $6,605,585. From this is to be deducted interest and other charges, $931,219, and dividends, $4,309,607, leaving a surplus of $1,364,758. The total surplus of the company is given at $11,617,741. It has 715,591 miles of wire and 187,981 miles of poles. There were 59,148,343 messages sent last year. There was an increase in expense due to repairs after storms, repairs of both Atlantic and one Gulf cable, and the fire in the main building. The average tolls per message were 32.5 against 32.4 last year. The average expense was 23.2 against 22.7 last year.

A magnetic well has been discovered at Summerville, N. Y. A resident of that place, writing to the *Rochester Times*, says:

"The facts are these: From the surface of the ground the sand and gravel is sixteen feet thick. Then comes a bed of blue clay thirty-seven feet thick; then one foot of gravel. At this point there is plenty of water which is red with iron. Then, after going through thirty-nine feet seven inches of rock, which contains iron ore, Captain Doyle struck this magnetic mineral well. The water contains quantities of iron and salt. The actual properties of the water can only be told by an analysis, which will soon be made. The tubing of the well is so strongly magnetized that by rubbing my pocket knife blade on it for two or three minutes, I was enabled to lift a five-penny nail on its point."

THE DIXON ELECTRIC LIGHT AND POWER PLANT.

The central station at Dixon, Ill., for supplying current for light and power, has recently been enlarged and rearranged by the Pond Engineering Co., and as the plant is considered a model equipment a short description of it will be found interesting.



Dixon Electric Plant.

The station was first equipped with one 14 by 13 Armington & Sims Engine. One 650 light Thomson-Houston alternating dynamo, and one 50 light T.-H. arc machine, with the regular quota of boilers, pumps, heaters, etc. The engine was put in by the Pond Engineering Co., under the superintendence of their Chicago manager, Mr. Albert Blanchard. A year later, the demand for light being considerably greater than the capacity of the plant, another engine of the same make and size was added, and the dynamos were duplicated. The Pond Engineering Co. took this opportunity to equip the station with one of the model plants of the West.

The accompanying illustration shows a view of the dynamo room; the company is particularly proud of the neat and ship-shape appearance of all the machinery and apparatus. The engines, dynamo, ceiling, steam pipes and all foundations are enameled white, with the exception of the field magnets of the dynamo, which are painted a bright red. All guards about the machinery are of polished brass, which, with the finished work on the machinery, are kept without tarnish. The floor is laid with narrow maple flooring, polished in oil.

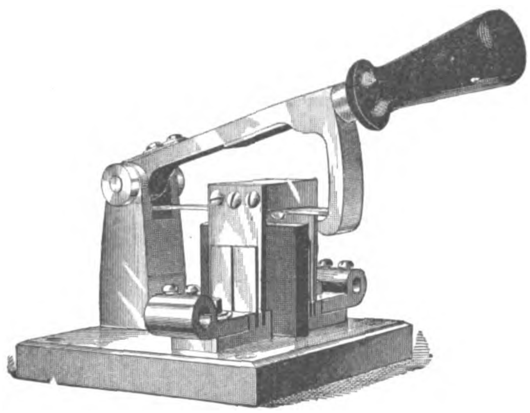
Mr. McDugal, the electrician in charge, takes great pleasure and pride in having a place for everything, and keeping everything in its place; he is very careful in making any changes, so as to avoid any trouble which might cause a shut-down. So far he has been very successful, as we have only learned of one stop during the time of his being in charge, nearly two years.

It is too often the case that the management of such enterprises think that beautifying a plant is a needless expense, but, as a general rule, it is found that where the management takes an interest in the clean and tidy appearance of the station, the engineer and his co-workers take a greater pride in their work, and spend their spare moments to advantage.

The officers of the Dixon Electric Light and Power Co. are: F. A. Watson, president and general manager, J. P. Plummer, secretary and treasurer and A. J. McDugal, electrical engineer.

THE WESTON QUICK-BREAK SWITCH.

The accompanying illustration shows the new railroad switch just brought out by Wm. H. Weston & Co., of Philadelphia. This switch has been especially designed to meet the requirements of railway work. The working parts are made of highly polished red brass and hard-rolled sawed copper, mounted on a marbleized slate base. The switch is of good design mechanically, the wearing parts are heavy and durable



Weston Quick-Break Switch.

and can be easily replaced, as all parts are interchangeable. The contact surfaces are of ample proportion to carry the rated current without heating, and the breaking is done so quickly that no arc can be formed. At present the switch is made in three sizes—the first to carry 150 to 200 amperes, the second 250 to 300 amperes, and the third 350 to 450 amperes. Special sizes up to 1,000 amperes can be made if required. This switch will be on exhibition at the Pittsburgh Convention.

THE CREAGHEAD TROLLEY LINE INSULATOR.

The excellent insulating properties of glass are recognized by all and glass insulators would no doubt have been adopted for trolley line insulation before now, had any one devised a practical plan of connection between the trolley line and the span wire to secure the insulator against breakage. Glass insulators on the wooden pins have been used in all electrical line work for years. The wood, acting as a cushion, adapts itself to any condition arising from unequal expansion of the wood and glass, and the insulators are seldom broken by internal causes.

The Creaghead Engineering Company, of Cincinnati, have designed a glass trolley wire insulator, shown in Fig. 1. It consists of a grooved glass insulator into which is screwed a wooden plug. The foot or trolley clamp is supported and screwed to the insulator by means of a bolt passing entirely through the wooden plug. The bolt has a round head at the top and a thread at the bottom and is screwed into the clamp. The method of connecting the insulator to the span wire is very simple and perfectly efficient. The yoke, shown in Fig. 2, fits loosely in the groove of the insulator, as shown in Fig. 1. The inner curve of the yoke, which is in contact with the insulator, is a half circle with a slightly larger radius than that of the smallest circle of the groove. It is necessary to separate the yoke from the insulator about ¾-inch before it becomes disengaged from the groove. The yoke can be put

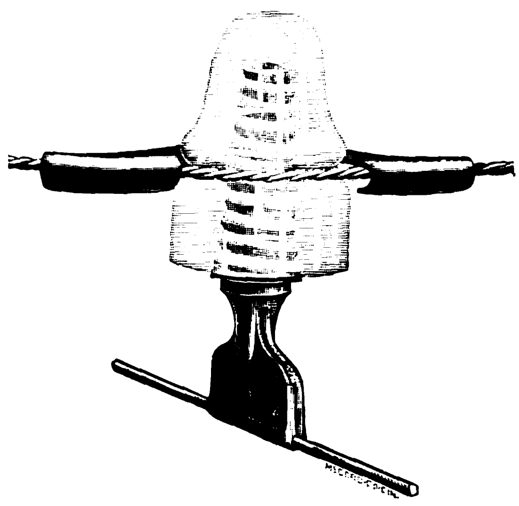


Fig. 1—Creaghead Trolley-wire Insulator.

on and taken off the span wire easily and without tools. All strains tend to increase the hold of the yoke and span wire on the insulator. While the attachment of yoke and trolley wire is secure,

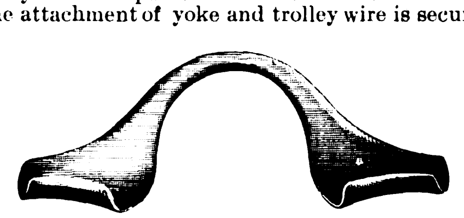


Fig. 2—Yoke of Insulator.

it is at the same time flexible and will adjust itself to unequal expansion of materials. The results obtained with this insulator, when in use, fully satisfy the company's expectations.

REPRESENTATIVES AT THE STREET RAILWAY CONVENTION.

The following are some of the gentlemen that expect to go from Chicago to represent their companies at Pittsburgh:

Electric Merchandise Company, W. R. Mason, A. H. England, D. B. Dean, W. L. Adams. Electrical Supply Company, Wm. Taylor, M. M. Wood. Central Electric Company, W. H. McKinlock. Westinghouse Street Railway Company, J. L. Barclay. Edison General Electric Company, Wm. F. Brewster, W. S. Elliott. Great Western Electrical Supply Company, T. C. Rafferty. Thomson-Houston Electric Company, Theo. P. Bailey, G. V. Wheeler, C. D. Rusling. Griffin Car Wheel Company, F. L. Whitcomb, A. G. Wellington. Burton Electric Heater Company, Dr. W. Leigh Burton, W. R. Mason, Dr. John Mahoney. Adams & Westlake Company, M. W. Willits, F. B. Jones. Chas. Munson's Belting Company, J. H. Fay. McGuire, Manufacturing Company, W. A. McGuire W. J. Cook, M. C. Hubbard. Patton Motor Company, W. H. Patton. E. P. Preston & Co., C. E. Jenkins. Most of the above firms will exhibit some of their specialties and it is evident that Chicago will be well represented, as is usual at all conventions where electricity plays a prominent part.

Messrs. H. Ward Leonard & Company are giving an extremely interesting exhibition at their offices in the Electrical Exchange Building, 136 Liberty St., New York. A Crocker-Wheeler motor is shown in operation under Mr. Leonord's new principle for controlling the speed, torque and direction of motors. The motor performs various work in such a manner as to clearly show the principle used and the facility with which either the speed or torque is controlled.

THE LATEST FROM LLEWELLYN PARK.

Mr. Edison announces through the newspapers, the completion of an electric railway system, suitable for long distance work, on which he has been experimenting for years. According to the newspaper accounts, current is supplied through the rails, each rail forming one side of the circuit, the motor being in multiple. The difficulties of insulation are avoided by using a very low pressure, about 100 volts, but the reporters apparently did not enquire how far power could be transmitted from the generating station, under this pressure, without great loss. Mr. Edison said that by his new system the speed of electrically propelled trains would be as great as that of those hauled by steam locomotives.

The Frankfort electrical exhibition was closed to-day.

FROM NEWS CENTRES.

NEW YORK.

New York, Oct. 17.—New York's Rapid Transit Commissioners came in for loud and outspoken comment this morning from thousands of business men and employes, who were detained for three-quarters of an hour on the upper west side of the city because of an accident to an elevated railroad engine, which blocked all south bound traffic for that length of time. Had the mishap occurred two hours later the consequent confusion would have been comparatively small, but happening at 8.15 on Saturday, the short business day, the loss of time was to many a matter of serious moment. If there were any immediate necessity to canvass the vote of the people on the proceedings of the Commission, the task this morning would have been an easy one, and the nature and emphasis of the vote would have been somewhat startling to the men who have been dallying so long with the chance of doing a valuable service to the city.

President Steinway said yesterday that the Rapid Transit Commission had, at length—at very great length—reached a final conclusion as to the plans of construction of the road which has been laid out, and would report to the aldermen on Tuesday next. The plan adopted is believed to be that of Chief Engineer Worthen, and the plan of Assistant Engineer Parsons for a double-decked tunnel road for the section of the road between the City Hall Park and Twelfth street is understood to have been overruled. It is said that the decision of the Commissioners favors the running of a four track road from the City Hall Park to the Harlem River, over the designated route. The road from the City Hall Park to Bowling Green is to consist of two tracks in a single tunnel, and from Bowling Green around through State and Whitehall streets there will be a single-track loop back to Broadway. A two-track loop will run around the City Hall Park, with side tracks under the park, and a similar loop with similar side tracks and switches will run around Union Square, while through the Boulevard the road will run through two tunnels close to the surface of the street, one on each side of the central grass plot that runs through the street, with the stations centrally located between the two tunnels. Nothing more can be said on this subject until the plans of the Commission are placed before the public. If the Commissioners, in spite of their long delay have done faithful and honest work, and have evolved a plan that will to the fullest degree meet the requirements of the city, they will have earned the grateful thanks of the community; but should their decision suggest the influence of private or political interests, the city just now is in a mood to be persistent in knowing the reason why.

A most valuable contribution to the subject of deep tunnel electric railways has been made in an article in the *Times*, by H. Loewenthal, city editor of that paper, who, during a recent visit to London, took occasion to make a thorough examination of the Greathead Tunnel system as carried out on the City & South London road. He points out the faults of the road, and at the same time shows that these faults are not inherent in the system, but extraneous and easily remedied. He insists that the system, with some modifications and improvements would be admirably adapted for New York City. In view of its prospective value, at an early date, as a piece of impartial testimony, one part of Mr. Loewenthal's article may be quoted here with advantage: "When the road was built, a prejudice had to be overcome. People did not care to ride so deep underground, any more than for a long time they cared or dared to ride overhead. But, little by little, they discovered the road was safe and speedy, and the travel is constantly increasing. Nowadays, as the writer can testify from personal experience, men, women and children ride through the tunnels without the slightest evidence of concern or apprehension. It has become as much a matter of course as the tramways, or horse-roads, as we call them."

The meetings of the Board of Electrical Control have lost much of their old-time snap. In the early days of Mayor Grant's administration if it was often difficult to take the deliberations of that august body seriously, they seldom failed to elicit the lively interest of those who had the privilege of being in the audience at the mayor's office. If there was not much instruction there was some amusement, and wit not infrequently supplied the place of wisdom. Now, however, the proceedings seldom rise above the normal dead level of official routine, and they afford little interest to the outsider. The main business of the board's meeting on Thursday was to listen to Ex-Judge Kelly's objection on the part of the East River Electric Light Company to pay more for the use of the subways than it was worth, and to paying the rent in advance. The counsel for the Subway Company said that other companies did not object to paying the rent in advance, and a decision of the Supreme Court had given the Subway Company a right to collect their bills that way. He created a feeling of resentment in the minds of the representatives of the East River Company by adding that there was no reason why the Subway Company should wait a year and then sue for the money, and perhaps get only five cents on the dollar. It was finally agreed that the East River Company should pay one-fourth of the rent in advance, and the question of paying all in advance was left over to be considered at a special meeting to be called by the mayor. As the matter now stands the East River Company claim that the rates charged by the Subway Company are so high as to make it impossible to carry on business at a profit.

Articles of incorporation have been filed in the office of the Secretary of State for the Edison Illuminating and Power Company, of Trenton, which proposes to devote itself to lighting the city of Newark, and other lines of business. The first capitalisation of the company is reported to be \$500,000, but it is understood that the capital will be increased to \$1,000,000 at an early date.

G. F. Cummings, of this city, is about to place in the hands of the Western Union Telegraph Company, for use in its display at the World's Fair, a very interesting relic, one of the first cipher messages written in the Morse code. Mr. Cummings came into possession of this relic through the following invitation to his father:

"Prof. Morse requests the honor of the presence of Thomas S. Cummings, Esq., and family, in the Geological Cabinet of the University, Washington Square, to witness the operation of his electro-magnetic telegraph at a private exhibition of it to a few friends previous to its leaving the city for Washington. The apparatus will be prepared precisely at 12 o'clock on Wednesday, the 24th inst. The time being limited, punctuality is especially requested. Please show this at the door." The invitation is dated Jan. 22, 1838, and is addressed from "New York City University." G. H. G.

BOSTON.

Boston, Oct. 17.—The Municipal Signal and Inter-communication Co., of this city, has just completed an installation of its system in one of the precincts of Cambridge, Mass. A contract has been secured for completely equipping the city of Brockton with the system, which, for police alarm service, is the system *par excellence*. Mr. A. H. Chapman, the general manager of the company, reports business more flourishing than at any previous period since the company was incorporated, and has enough business in hand to keep the constructing staff busy for at least a year. During 1890 more than 2,500,000 calls were made by the police force of Boston, which is equipped throughout, having in regular service nearly 500 call-boxes. Wherever used this system gives unbounded satisfaction.

Though not many months in the field, the firm of Pinkham & Godfrey, constructing electrical engineers, have secured many good contracts, among which is a large one now in hand at the State Capitol, Albany, N. Y., where they are doing the wiring for lights, dynamos and motors.

The Germania Electric Co., Boston, is experiencing some difficulty in catching up with the orders for its efficient lamps, which are now in demand in every part of this country. Orders for these specialties also bring orders for the other high grade apparatus made by the company. With the assistance of the distinguished inventor Captain de Khotinsky, who is now identified with the company, it is reasonable to predict a most prosperous future.

The Boston and Revere Electric Railway will be built shortly. Authority to construct has been granted the company, and ere long the residents of Revere and Winthrop, the two favorite suburban marine resorts, will be able to reach Boston by electric cars.

There is at present not a single electrical firm in or near Boston that is not as busy as it can be, and in some instances I have heard of orders declined, owing to the absolute impossibility of executing them in anything like reasonable time.

On Wednesday electric cars began to run from Jamaica Plain through to the northern depots, to the great satisfaction of residents in that popular suburb. The West End R. R. Co. announces for the present, and until the entire Tremont St. and territory systems are equipped by electricity that the cars will stop wherever passengers desire. Afterwards, however, it is intended to have certain fixed stopping places, which will be announced presently, where passengers can get on or off the cars, no stops to be made at intermediate points.

An electric tramway has been contracted for by the Cumberland Mfg. Co., Westbrook, Me., which will be equipped with the Thomson-Houston system. The track will connect the mills with the railway near by, and will be used for hauling freight and coal. A seven h. p. electric locomotive will be used.

The New England branch of the Edison General Electric Co. has secured the contract for supplying four Edison 45-1200 c. p. arc light dynamos to the Arlington and Rockland, Mass. Electric Light and Power Co. Also a contract for four 45-1200 c. p. arc light machines for street lighting at Franklin Falls, N. H. The Rutland, Vt. Electric Light Co. has ordered two 450 incandescent light machines to increase its plant. The Weeks Building, Boston, is being equipped with an isolated Edison plant, including four 270 incandescent light machines. The Perkins & Young Mfg. Co., Lisbon, N. H., has also ordered an isolated Edison plant; a similar plant is about to be installed in the paper mill at Simapee, N. H. During the last ten days upwards of twenty motors have been sold from the New England office. Within the last few days a contract has been secured for the entire equipment both steam and electric of the new municipal plant which the citizens of Peabody, Mass., have decided to establish.

A committee of the Fall River, Mass., City Council has been investigating a proposition to establish a municipal electric lighting plant, and has just reported against the project. An interesting feature of the report is the statement of the estimated cost of a 500-light plant for that city, which is as follows: Land \$15,000, buildings \$20,000, chimney and connection \$5,000, steam plant, pumps and connections \$25,000, electric plant, consisting of ten 50-light dynamos and connections \$42,500, auxiliary apparatus, 20 per cent., \$13,500; 500 2,000-c. p. lamps at \$80 each, \$40,000; poles, wires, etc., at \$100 per lamp, \$50,000; total cost, \$211,000. Estimated cost of maintenance \$84,232, a little more than 46 cents per light. The cost for 200 lights would be considerably more proportionately, say between 55 and 65 cents per light.

The W. S. Hill Electric Company has recently been incorporated and has purchased from Mr. W. S. Hill, the well known electrical inventor and manufacturer, the whole of his inventions relating to dynamos, motors, lamps, switches and other devices. The company will at once enter into the manufacture of these specialties on an extensive scale. The factory on Oliver street will be doubled in capacity immediately and a large staff of first class operatives employed. For some time past Mr. Hill has enjoyed a constantly increasing demand for his double pole switches, station switches, arc lamps and switch-board apparatus. The chief office at present is at 54 Devonshire street, and the factory address at 133 Oliver street. The company is composed of several western capitalists, including George A. Denham, Sioux Falls, Ia.; G. H. Poor, St. Louis, Mo., and Chicago; Judge Gould of Portland, Me., and Louis F. Bussel, Laconia, N. H. The above, with W. S. Hill and Louis E. Hill, constitute the board of directors, the officers being W. S. Hill, president; G. A. Denham, treasurer; G. H. Poor, general manager, Louis E. Hill, superintendent of factory. W. S. K.

SAN FRANCISCO.

San Francisco, Oct. 5.—A misunderstanding has arisen between the Southern Pacific Company and its telegraphers who are members of the Order of Railroad Telegraphers of North America. The Order claims that the Company is discriminating against the members and is opposed to its getting a foothold on the Pacific coast. There are about a hundred members of the Order in the employ of the railway; and it is rather strong otherwise by reason of its amalgamation with the Brotherhood of Telegraphers. The railway company has discharged seven members of the Order. Grand Chief A. D. Thurston is now in Oakland trying to adjust matters and is sanguine of success.

Men are at work stringing the overhead wire of of the San Francisco and San Mateo Electric Railway. President Joost has issued another declaration that all reports concerning the financial distress of the road are unfounded. Only \$35,000, he says, is needed to complete the work and put the

road in running order. Horse cars have been sent over the road to test the gauge and curves.

A "norther" visited Monterey last week and after a day's blow the wires of the electric light company were completely disabled. The town was in darkness for several nights. The Alameda City trustees have laid on the table all the applications for electric light franchises, and the impression prevails that the project of selling the municipal plant has been abandoned on account of the opposition of the citizens.

The street railway war in Los Angeles continues as stubbornly as ever. George Whittell, a director of the Pacific Rolling Mills, which is building the electric road, in speaking of the situation, said: "In my opinion all hope of any sort of a compromise between the cable and the electric road people is futile, for the reason that the affairs of the cable company are in such a state that any arrangement with it is for the present impossible. The first and second mortgage bondholders of that road are quarreling among themselves. In addition to this the cable people are in an openly declared fight with the electric railroad people, and are using every endeavor to hinder the electric company from building their track."

The Los Angeles electric road has scored a strong point in the Supreme Court over its rival, the cable road, which is in the hands of a receiver. The question before the court was whether a Superior Court judge could appoint a receiver of a cable railway company and on that receiver's motion grant a right of way over the lines of the company whose affairs were in the hands of such receiver. The opinion holds that the property of the petitioners (the cable road company) is in *custodia legis*, and therefore the court can grant a right of way to any person or corporation and assess damages to be paid therefor, without citing or consulting the corporation, but simply on the application of the receiver in possession of the property.

It has been a long and stubborn fight, but the electric road has now succeeded in crossing the track of the cable road. Last week the attempt almost created a riot, and several arrests were made. The cable force ran cars on the crossing and filled in the excavations made by the electric workmen as fast as they were made. A force of 42 policemen was required to prevent an actual battle between the antagonists.

In Los Angeles there has just been completed the only electric tower clock in the United States. It has been set in operation in the lofty turret of the new court-house. The great hands of the clock and every clock in the building are controlled by a delicate watch-like regulator in the supervisor's room. In Rome there is one of these clocks, in Paris two, and in England there are several.

B.

COMMERCIAL PARAGRAPHS.

The Elektron Mfg. Co., makers of the Perret electric motor, have moved their manufacturing plant and general offices from Brooklyn to Springfield, Mass. They have also fitted up offices, storerooms and workshop at 89 Liberty St., New York City.

Badger Bros., West Quincy, Mass., are doing well with their patent self-oiling trolley wheel, which is finding general acceptance on electric street railways. It is now in use on the West End Railway, Boston, Quincy Electric Railway, Brockton Street Railway and others.

Albert and J. M. Anderson, Boston, will have an exhibit of their many electric railway devices at the forthcoming convention at Pittsburgh.

W. P. Mullen, vice-president and Eastern manager of the Shultz Belting Co., reports business for September big and "best yet." He has been down at Providence this week completely equipping a big factory there with Shultz belts, including several of the leather woven link type.

The Electric Merchandise Co., Chicago, report constant and daily orders for the Burton Electric Heaters. Electric heating has come to stay and its great advantages are recognized by managers of electric street roads.

The Electrical Supply Co., of Chicago, are having an excellent trade with street railways. They report large orders for Habirshaw and Shield Brand wires. The Wirt Lightning Arrester is still in great demand.

The Wheeler Condenser & Engineering Company has recently filed articles of incorporation with the Secretary of State at Trenton, N. J. The company has bought out the entire plant and business of The Colwell Iron Works, at Carteret, N. J., which is one of the largest concerns in this country manufacturing vacuum pans and special machinery for sugar refineries, salt works, condensed milk factories, etc. The Wheeler Company will continued to manufacture Wheeler's Patent Surface Condensers and others of his specialties. The capital stock of the company is $300,000, and the incorporators are as follows: Fred'k. Meriam Wheeler, of Montclair, N. J., Aaron Vanderbilt, of New York City, Clifton H. Wheeler, of Brooklyn, N. Y., William H. Hampton, of New York City and Charles W. Wheeler, of Brooklyn, N. Y. The headquarters of the company will be at 92 and 94 Liberty Street, New York City.

The Interior Conduit & Insulation Co. will be represented at the Street Railway Convention at Pittsburgh, by Mr. E. H. Johnson, President, and Mr. E. T. Greenfield, Electrician. The company will show their improved method of burying the feeder wires of electric railway systems and their new junction box.

The Smith & Vaile Co., of 112 Liberty St., New York, manufacturers of the Duplex Steam Pump, are the patentees of a "Removable Water Cylinder" and "Adjustable Water Piston." The advantages of these devices are that the natural wear is readily compensated for and the large slippage of water of the usual style of Duplex pumps is entirely prevented.

The Pond Engineering Company report an excellent demand from their various offices for Armington & Sims engines for electric light and power stations. They are now furnishing engines for the State Insane Asylum, San Antonio, Texas; Pacific Branch National Soldiers' Home, Santa Monica, Cal.; Edison General Electric Company, for Traverse City Asylum, Traverse City, Mich.; Waterloo, Ill., Electric Light Company; Provident Life Assurance Building, Waco, Texas.

The Electrical Manufacturing Company, 73 West Jackson street, Chicago, has just issued a very neat circular, calling attention to the testing and calibrating department which the company has recently started. It is the intention of the company to pay special attention to repairing and recalibrating all kinds of electrical testing instruments Mr. E. W. Hammer has been engaged as electrician and will have charge of the department.

INCORPORATIONS.

The Franklin Electric Company (incorporated in W. Va.), New York, N. Y.; capital stock, $5,000,000; to manufacture, sale, lease, use, maintain and license of accumulators, primary and secondary batteries, motors and machines for light, heat and power by electricity, contracting for same; promoters, Geo. B. Waterhouse, Passaic, N. J.; Frank K. Irwing, 67 McDougal street, Brooklyn, N. Y.; Henry M. Munsell, 6 W. 84th street, New York.

The A. C. Seibold Company, New York City, N. Y.; capital stock, $5,000; manufacturing and selling electrodes for arc lamps and other devices used in electric lamps; promoters, Albert C. Seibold, Mt. Vernon, N. Y.; Edgar O. Clark, 7 Dutch street, New York, N. Y.

Cataract Electric Company of Buffalo, Buffalo, N. Y.; capital stock, $40,000; the manufacture and use of electricity for light, heat and power; promoters, Charles A. Sweet, Franklin D. Locke, Edmund Hayes, William Hamlin, Patrick H. Griffin, all of Buffalo, N. Y.

Butler Electric Light and Gas Company, Butler, Mo.; capital stock, $15,000; to buy, own and control the material, machinery, devices and appliances for manufacturing gas and electricity for lights, illumination, etc.; promoters, Arthur L. McBride, Thomas W. Legg, Thomas W. Silvers and George W. Canterbury, Butler, Mo., and John A. Keller, St. Charles, Mo.

Granite City Electric Company, Barre, Vt.; capital stock, $50,000; generating electricity for light and power; promoters, E. L. Smith, R. S. Currur, Barre, Vt.; E. D. Blackwell, Montpelier, Vt.

Alexander-Chamberlain Electric Company, New York City, N. Y.; capital stock, $1,000; electrical engineering, construction of electrical works, etc.; promoters, Hugo Alexander, 348 W. 145th street, New York City, N. Y.; Harry Alexander, 126 Liberty street, New York City, N. Y.; Rudolph N. Chamberlain, 126 Liberty street, New York City, N. Y.

Cumberland Electric Light Company (incorporated in W. Va.), Pittsburgh, Pa.; capital stock, $100,000; manufacturing, constructing and operating all kinds of electrical apparatus for light and power, and all other business for which electricity may be applied; promoters, James S. Humbird, Harvey L. Childs, Frank S. Marr, all of Pittsburgh, Pa.

The Logansport Electric Light and Power Company, Logansport, Ind.; capital stock, $60,000; manufacturing, selling and furnishing electric light and power for profit in the City of Logansport, Ind.; promoters, R. T. McDonald, E. J. Hathorne, Joseph Seiter.

Glenwood Heights Company, Charleston, W. Va.; capital stock, $52,000; to maintain and operate electric lights and furnish same for light, heat and power; promoters, John Alleman and P. F. Duffy, Charleston, W. Va.; L. A. Christy, Winfield, W. Va.

W. D. Hyslop Electric Company, La Fayette, Ind.; capital stock, $10,000; to manufacture and sell electrical and surgical instruments and metal novelties; also the making of models and experimental work; the conducting of general electro-plating of all kinds; promoters, William D. Hyslop, R. H. McMullan and John B. Sherwood.

The Crouch-Marston Electric Manufacturing Company, Eugene, Oregon; capital stock, $1,000,000; to purchase, own, hold, use, sell, rent and dispose of any and all letters patent and inventions of whatever name and nature heretofore patented to Frank J. Crouch and especially the invention of Frank J. Crouch, called the Crouch Safety Dynamo; promoters, Frank J. Crouch, Eugene, Ore.; C. P. Houston, and W. L. Houston, Junction, Ore.

Bates & Blake Electric Railway Conduit Company, Waterloo, Iowa; capital stock, $1,000,000; the manufacture and sale of "Bates & Blake Electric Railway Conduit and Trolley," also railway supplies in general; promoters E. P. Caldwell, Joseph W. Bates, Jr., Carlestino E. Blake, Edwin C. Blake, Chas. E. Hale, all of Minneapolis, Minn.; J. D. Caldwell and E. C. Platt, of Waterloo, Iowa.

Kensington Electric Street Railway Company, Allegheny Co., Pa.; capital stock, $12,000, for operating a street railway in the borough of Kensington, Allegheny Co., Pa.; promoters, Jno. S. Alles, S. Stafford, A. E. Alles, Henry Alles, Sr., Jacob Alles, all of Pittsburgh, Pa.

Thomson-Houston Electric Light and Power Company, Sharon, Mercer Co., Pa.; capital stock, $30,000; promoters, D. W. Dunn, Allegheny; Edward G. Waters, A. W. Williams, Pittsburgh, Pa.

The J. C. Chambers Electric Sanitarium and Supply Company, Detroit, Mich.; capital stock, $50,000; promoters, Josephus C. Chambers, Thomas Rollinson and Chas. C. Wilmot, all of Detroit, Mich.

Madisonville Electric Light and Power Company, Madisonville, Ohio; capital stock, $30,000; promoters, Jno. G. Luhn, Edwin S. Emerson, Jno. S. Nowotny, F. R. Lindsley, J. G. Rawn.

Fredonia Electric Light, Heat and Power Company, Fredonia, N. Y.; capital stock, $30,000; promoters, George Barker, Frederick R. Green, John A. Warren, Benj. F. Skinner, Louis McKinstry, all of Fredonia, N. Y.

Washington Illuminating Company, Washington, Iowa; capital stock, $50,000; operating gas and electric light plant in Washington, Iowa; promoters, Norman Everson, E. E. Everson and B. W. Hunt, Washington, Iowa.

Algiers Ice Manufacturing Company, New Orleans, La.; capital stock, $50,000; to manufacture ice and operate water works and electric lights; promoters, William Wenzel, Peter Blaise and George D. Hite, all of New Orleans, La.

The Shawanee and Straitsville Electric Light Company, Shawanee, Ohio; capital stock, $25,000; promoters, David L. Sleeper, A. S. Bethel, E. McLellan Posten, William L. Kessinger, Herbert S. Burson.

The Suburban Electric Railway Company, Bucyrus, Ohio; capital stock, $200,000; promoters, W. C. Lemert, G. Donnenwrith, C. W. Fisher, O. L. Hayes, John Blyth, N. A. Sager, J. W. Gwynn, J. B. Gormly.

Buffalo, Kenmore & Tonawanda Electric Railway Company, Buffalo, N. Y.; capital stock, $150,000; promoters, Louis F. W. Arend, Frederick G. Sikes, Geo. H. Frost, all of Buffalo, N. Y.

Pulaski Electric Company, Pulaski, Va.; capital stock, $25,000; Electric Light, Heat and Power; promoters, J. R. Miller, J. W. Lyons, R. E. Watson, R. B. Berkeley, G. L. Colgate.

Pulaski Light and Water Company, Pulaski, Va.; capital stock, $250,000; Electric Light and Water Works; promoters, J. H. Dingee, J. M. Wigeman, W. H. Triol, E. Graves, Philadelphia, Pa.; H. Alexander, Pulaski, Va.

The Pacific Coast Fuel and Gas Company, Chicago, Ill; capital stock, $5,000,000; to build, erect, operate, sell and buy plants for furnishing gas and electricity for light, heat and power purposes; promoters, Levarth Annison, Calvin C. March, Luke T. Drury, Henry H. Miller, Jas. Craig.

Attica Electric Light and Power Company, Attica, N. Y.; capital stock, $20,000; promoters, Joseph Birt, Buffalo, N. Y.; Erastus B. Wallis, Andrew Krauss, Attica, N. Y.

Leslie Electric Light and Power Company, Leslie, Mich.; capital stock, $10,000; promoters, J. A. Hanelly, V. H. Grout, and A. A. Lumbard, all of Leslie, Mich.

Peoples Electric Light and Power Company, Creston, Iowa; capital stock, $12,000; promoters, Markemer Bros., W. A. Tipton, F. A. Sparr, A. H. Sparr, Beecher & Miller, Lewis & Cole, S. A. Brewster, Creston, Iowa.

St. Paul Electric Manufacturing and Construction Company, St. Paul, Minn.; capital stock, $100,000; promoters, Paul Martin, James F. Hughes, Charles H. Lienan, St. Paul, Minn.

Ogden Street Railway Company, Chicago, Ill.; capital stock, $2,000,000; to build and operate street railways to be operated by any motive power except steam locomotives; promoters, Houston C. Adcock, Nathan G. Moore, Edward P. Towne.

Chicago Electric Wire Company, Chicago, Ill.; capital stock, $1,000,000; to manufacture and deal in insulated wire and cable and electrical apparatus and supplies generally; promoters, J. W. Dyrenforth, C. N. White, J. N. Hanson.

Iron Cross Investment Company, Basic City, Va.; capital stock, $50,000; real estate and improvements, building, street railroads, gas and electric works; promoters, W. V. Kirk, E. P. Cohill, J. W. Kirk, P. H. Gold, P. E. Stigers, C. H. Purcell.

STREET RAILWAY NOTES.

After much competition the contract for electrical equipment to be used on the East Liverpool & Wellsville Railway has been awarded to the Short Electric Railway Company. The road will be about eight miles long, connecting Ohio City, Wellsville and East Liverpool, with the power station in the last named place. Eighty-two-pound Johnson girder rail will be used throughout the entire road, grading for which has been pushed vigorously. A force of five hundred men has been at work for two weeks on the roadbed, which has been cut and filled according to the best practice for steam railways; when completed it will be practically level. Thirteen acres of ground have been purchased in East Liverpool, on part of which a handsome red brick power station is building. Power will be furnished by two 150 h.p. Reynolds-Corliss engines with two 300 h.p. boilers and a Worthington Duplex pump. Two Short Multipolar slow speed dynamos of 150 h.p. each, and a handsome marbleized slate switchboard of the latest Short type, fitted with all necessary appliances for the modern electric power station will complete the equipment of the station. Seven twenty-six foot car bodies have been purchased from the J. G. Brill Company, Philadelphia. These will be equipped with fourteen Short "Gearless" motors, having a capacity of 20 h.p. each. The line construction will be on the Short System throughout. It is expected that the road will be put in operation on Thanksgiving day, when the citizens of the two enterprising towns have arranged to decorate their streets and cars, and to give a banquet in honor of the occasion. The usually quiet streets of both East Liverpool and Wellsville are now filled with foreign workmen, several hundred men being employed at different points along the line. The greatest enthusiasm has been shown from the start by the people of the two towns, the cause of their hearty co-operation being the prospect of relief from the steam cars which have been their only method of communication thus far.

The Electric Merchandise Company report for the last week sales of Burton Electric Heaters to the following railways: Spokane Electric Ry., Spokane; Danville Electric Ry., Danville, Ill.; Stillwater Electric Ry., Stillwater, Minn.; Terre Haute Street Ry. Company, Terre Haute, Ind.; Burlington Electric Ry., Burlington, Iowa; Reading & Southwestern Ry., Reading, Pa.; Eau Claire Street Ry., Eau Claire, Wis.; Peoples Street Ry., Springfield, Ill.; Salt Lake Rapid Transit Co., Salt Lake City, Utah; Minneapolis Street Ry. Co., Minneapolis, Minn.; Electrical Supply & Construction Co., Pittsburgh, Pa.; Pullman Palace Car Co., Pullman, Ill.; Windsor & Sandwich Ry., Windsor, Can.

The Board of Education of Chicago has approved of the recommendation of the Committee on School Fund Property that it give its consent to the passage of an ordinance granting to the Rapid Transit Company of Illinois the right to construct and maintain an arcade or underground railroad in Monroe street. The School Board owns property on the north side of Monroe street, from State to Clark street. The lease-holders of the property have given their consent to the construction of the proposed railroad, but it was thought necessary that the board should also give its consent.

The electric railway between Hartford, Conn., and East Hartford, will probably be put in operation at an early date. The single trolley system will be used. Property owners along the line have made no objection, and the company now only awaits the consent of the Street Commissioners. Electric traction is quite a success in Hartford; the new line will be an important addition to the existing system, and other extensions are contemplated.

Mr. J. A. Rohmberg, president of the Dubuque Street Railway, operating the Edison system of accumulator cars, furnished by the Accumulator Company, of Philadelphia, was a visitor in Chicago last week. He reports that an extension of one mile of track to the line at Dubuque has just been completed. The cars are giving much satisfaction and the residents are delighted with the excellent service given by the railway company.

We have received from the enterprising publishers of the *Street Railway Journal* a "Souvenir Edition," issued in honor of the tenth convention of the American Street Railway Association. This publication is something quite unique in American technical journalism and can only be compared with the famous Paris Exposition and Forth Bridge editions of *Engineering*. It contains 74 pages of interesting matter, freely illustrated, relating to the Association and to street railways and other electrical industries in Pittsburgh. This handsome souvenir will certainly be prized by many as a valuable memento of the convention.

The Electric Merchandise Co., of Chicago, has issued a handsomely engraved letter of invitation to their friends to visit the Company's reception room at Parlor No. 5 of the Monongahela House, during the Street Railway Convention at Pittsburgh.

The Detroit Electrical Works will have one of their new standard 40-horse power electric cars, completely equipped by the Rae system, on exhibition during the Street Railway Convention. The novelty of this exhibit is that it will be in operation on the road of the Duquesne Traction Company, at Pittsburgh, during the holding of the convention.

The Short Electric Road at Rockford, Ill., is meeting with excellent success and is about to extend its lines. The service is very popular and the management is given credit by the citizens for installing one of the most perfect electric street railways in the country.

The Short motors have been in operation on the Georgetown & Tenallytown road for some two months with excellent results. They are carrying heavy loads at high speed and the cars are very popular. This road will be the first in the South to be equipped with the "Gearless" motors, an order having been placed by Mr. R. H. Goldsborough several months ago.

The "C. & C." Electric Motor Company, New York, are very busy. This company has recently installed a 75-light dynamo for the Snow Steam Pump Company, Buffalo, N. Y.

One 175-light dynamo for the Congdon Brake Shoe Company, 59th street, Chicago, Ill.

One 500-light dynamo in the Mitchell Flats, Cincinnati, Ohio.

Two 250-light dynamos in the St. Nicholas hotel, Cincinnati, Ohio.

One 125-light dynamo for Mock, Berman & Co., 119 West 3d street, Cincinnati, Ohio.

One 150-light dynamo for W. J. Morgan & Co., Cleveland, Ohio.

One 100-light dynamo for the Bethel Association, Cleveland, Ohio.

One 60-light dynamo for the Northern Ohio Asylum for the Insane, Cleveland, Ohio.

One 100-light dynamo for the Steamer "Royal," Evansville, Ind.

One 40-light dynamo for the Upton Glue Company, Gardiner, Maine.

One 40-light dynamo for the Boston Paper Company, Hallowell, Mass.

One 200-light dynamo for the iron foundry of T. Shriver & Co., 333 East 55th street, New York.

One 150-light dynamo for Messrs. Weser Bros., piano manufacturers, 524 West 23d street, New York.

One 40-light dynamo for the Upton Glue Company, Peabody, Mass.

One 150-light dynamo for Jordan & Goodrich Shoe Company, Ravenna, Ohio.

One 500-light dynamo for lighting the offices of the Brush Electric Light Company, Rochester, N. Y.

One 40-light dynamo for the Upton Felting Mills, Salem, Mass.

PERSONAL NOTES.

H. H. Cummings has returned to Boston after spending several weeks in Chicago.

Captain Willard F. Candee, Treasurer of the International Okonite Co., was in Chicago last week.

Clarence Brockman, formerly with the Mt. Sterling Electric Light and Power Co., has been engaged by the Electrical Supply Co., of Chicago, as traveling salesman to represent them in the states of Kentucky and Tennessee.

Mr. Harry Redheffer, the well-known salesman of the Electrical Supply Co., of Chicago, has severed his connection with that company.

H. M. Underwood has been appointed as general sales agent for the Knapp Electrical Works of Chicago. He is also representing in Chicago the Safety Insulated Wire and Cable Co., of New York.

C. L. Edgar, general manager of the Edison Illuminating Co., of Boston, is making an extended western trip, visiting many of the principal central stations for the purpose of introducing their most useful features in the new central station on Atlantic Avenue, work on which has already begun.

H. P. Reed, chairman of the town electric lighting committee, of Peabody, Mass., is receiving congratulations on the success thus far of his efforts to secure the establishment of a municipal plant. Mr. Reed is entitled to be regarded as the father of the new Municipal Lighting Act recently passed in Massachusetts; he initiated the movement and labored most devotedly and disinterestedly from its inception. Mr. Reed has no interest whatever in electrical matters beyond being a public spirited citizen strongly in favor of electricity as an illuminant.

Captain de Khotinsky, who has achieved a world-wide reputation by his system of incandescent lighting is now identified with the Germania Electric Co., of Boston, which controls the Khotinsky patents in this country. The company is about to erect a larger factory for the manufacture of all kinds of electrical apparatus under these patents. Captain de Khotinsky will superintend the erection of this factory and will be in charge of it when completed. As an electrical inventor he ranks very high in Europe and has achieved distinction in the Russian service, as well as with the Electriciteits Maatschappy in Rotterdam. An award in his favor was recently given in the French law courts in the case brought against the Rotterdam company by the Edison and Swan electrical companies combined. This, added to the fact that Khotinsky lamps have been adopted for illuminating the electrical exhibition at Frankfort, is an important victory for his system. The prosperous Germania Electric Co. is to be congratulated on having secured so distinguished an inventor as an addition to their staff.

The Crocker-Wheeler Motor Company has placed Mr. D. Herbert Jeffery, formerly general manager of Jeffery & Co., manufacturers of springs, Jersey City, N. J., in charge of the general offices, handling correspondence, management of records, etc. This appointment was necessary to relieve the other officers of the company of these duties, in order to enable them to meet the requirements of the several branches of the business, each of which is in charge of a responsible member of the company's staff.

Mr. C. A. Daigh, of the Electrical Engineering and Supply Company, of St. Paul, passed through Chicago recently en route for St. Paul. Mr. Daigh was lately in Audubon, Iowa, where he has just completed a municipal lighting station, having a capacity of 500 incandescent lights.

Mr. W. C. Clark, of the Pittsburgh office of the Westinghouse Electric Company, paid Chicago a visit this week as the guest of Mr. J. L. Barclay, western manager of the company. Mr. Clark will be at Pittsburgh for the Street Railway Convention.

At the last meeting of the Executive Committee of the National Electric Light Association, a resolution was unanimously passed, thanking Mr. John Carroll, of the Eugene F. Phillips Electrical Works, of Montreal, Canada, for his untiring labors in connection with the reception of the Association during its convention at Montreal. This resolution was ordered engrossed and presented to Mr. Carroll.

WHAT IS SAID OF ELECTRICITY.

ELECTRICITY. A WEEKLY JOURNAL PUBLISHED simultaneously in Chicago and New York. Electricity Newspaper Company, 307-308 Temple Court Building, Chicago. $2.50 per annum.

The prospectus of this journal announces that it is to be devoted to the advancement of electrical interests, and that it is to be an attempt to present the popular side of electrical matters, both practical and technical. It is based upon the assumption that a large class, deeply interested in electrical work, is unable to follow it in all its intricacies as technically presented in a lage number of electrical publications now extant. An examinction of the first and succeeding numbers shows that the attempt is intelligently directed and that a carefully edited, handsomely printed and valuable publication has been added to the list of electrical weeklies. The paper and typography and style of illustration leave nothing to be desired. A well selected summary of electrical news is presented.

The complimentary notice printed above appeared in the October number of *The Engineering Magazine*.

Seneca County Journal.

Any person who is at all interested in the study of electricity and electrical machinery cannot invest $2.50 any more profitably than by subscribing for the new publication called *Electricity*. Each issue contains, besides advertising, twelve pages, well filled with the latest and best electrical news. It treats upon electrical subjects, popular, practical and technical, and is well calculated to edify and instruct both practical workmen and electrical experts. It is printed on elegant paper, and typographically it is nearly perfect. We heartily recommend *Electricity* to our friends who are at all interested in this subject.

A new subscriber says: "I take several electrical papers, but like yours for its practical character much better than a purely technical journal."

American Machinist.

The first number is bright in appearance, and the publishers promise to keep it up to the mark in electrical matters. We wish it success.

Mechanical and Electrical Progress.

Electricity is fittingly the name of a new journal published in Chicago. Its aim is to present the popular, as well as the practical and technical side of electrical matters. It will be published weekly. In size of pages it is slightly larger than MECHANICAL AND ELECTRICAL PROGRESS. The illustrations and press work show attention to these important details.

The manager of one of the largest electrical companies in the country, in forwarding a subscription, writes: "Your paper specially commends itself to us, and in the near future we hope to be properly represented in its pages."

SPECIAL NOTICE.

The illustrations which we present from week to week are a special feature of ELECTRICITY. Many of them are original drawings executed by capable artists especially for this journal, and are of such a character that some of our readers will undoubtedly welcome the opportunity of obtaining proof copies for framing. The publishers wish to announce that they are now prepared to supply, to regular subscribers, proof copies of all illustrations appearing in ELECTRICITY. The prices will necessarily vary with the size of the pictures, but will be extremely moderate.

ELECTRICITY.

VOL. I. CHICAGO. OCTOBER 28, 1891. NEW YORK. No. 15.

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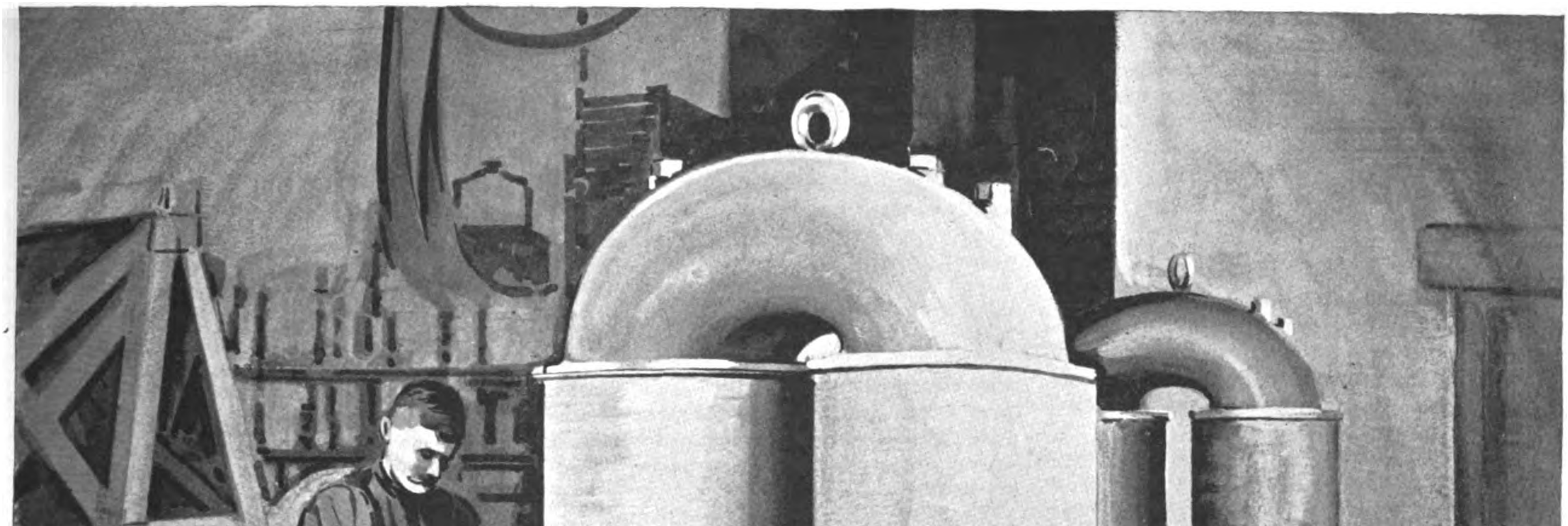
CONTENTS.

The alphabetical and classified lists of advertisers may be found on page iv.

WHEN you begin a business correspondence with an advertiser in these columns, kindly take the trouble to give ELECTRICITY *credit for the introduction.*

ELECTRICITY.

VOL. I. | CHICAGO. | OCTOBER 28, 1891. | NEW YORK. | No. 15



ASSEMBLING A ONE HUNDRED HORSE-POWER DYNAMO.

(*See page 190.*)

A REVIEW OF THE STREET RAILWAY CONVENTION.

The tenth annual convention of the American Street Railway Association will probably go on record as the most successful and brilliant gathering of men, minds and materials that has yet been brought together to represent the street railway industry, Nearly two hundred street railway companies, belonging to towns scattered all over the country, were represented at the convention, most of the companies having several delegates present. The total attendance was upwards of seven hundred, including the many officials of the electrical construction companies, and the staffs of the technical journals.

Mr. Henry M. Watson, the president of the Association, delivered a most interesting address at the opening of the convention, in which, after paying a deserved compliment to the hospitality of Pittsburgh, he dwelt very fully on the gigantic strides that electric traction has taken in the conquest of the street railway industry.

He said: The most important matters to be discussed in convention will be the problems which arise in the application of electricity to street railway traffic. It is a source of no little satisfaction to us to know that in the development of the electric railway America leads the world. Three years ago there were only thirteen electrical roads in the United States; now there are over four hundred, and the advices from every part of the country indicate that before the close of the present year the number will be increased to five hundred. The capital now invested in American electric railways exceeds $75,000,000. "Horse sense" counts for but little in this age of rapid transit. We old dogs have been obliged to learn new tricks, and without the usual privilege of serving an apprenticeship. Our stables are being converted into power-houses; the electrician has taken the place of the veterinary surgeon; our drivers are being educated as motor-men, and most of us have horse cars for sale.

Mr. Watson gave some interesting statistics of the street railway industry of the country, in which he showed that the electric cars in use outnumber the cable and steam cars combined. There are 6,732 electric cars now running, against a total of 4,361 cable and steam cars. Since November, 1890, the number of horses employed on street railway lines has fallen from 116,795 to 88,114; that is, 28,681 in one year. At this rate, it will not take long to emancipate the horse from street railway business.

The city having the greatest length of street railways is Philadelphia, with 510 miles of single track. Chicago follows next with 452 miles; New York has 289 miles, Brooklyn has 285; Boston, 283, St. Louis 275, Baltimore 207, San Francisco 205, Cleveland 192, Cincinnati 180, Pittsburgh 168, Kansas City 141, New Orleans 139, Louisville 132, Buffalo 110, Minneapolis 101, Los Angeles 99, Detroit 94, Birmingham (Ala.) 92, St. Paul 90, Washington 85.

Mr. Watson thought that they should not become so deeply interested in one form of transit as to lose sight of the good points of all others, and a report had been prepared on "A Year's Progress with Cable Motive Power."

"Where streets are straight, and grades are steep, and the traffic is limited only by the number of cars that can be operated, a well constructed cable system may have economic advantages that should be better understood. In our boyhood days a galvanic battery could always draw us away from the grindstone, and now, later in life, most of us find the dynamo, the engine and the switchboard of an electric power house, far more attractive than the heavy machinery of a cable plant. But, if under any conditions the cable system will give the best possible service to the patrons of a road, and make a better showing than electricity on the balance sheets, we want to know it."

"This convention is to be favored also with the third paper on the 'Public Treatment of Corporations,' by the Hon. G. Hilton Scribner, of New York. It is an old saying that corporations have no souls. Perhaps that is why they are prayed for so little and preyed upon so much. Most of us who have pooled our property in the belief that we can accomplish more for the people whom we are seeking to serve, than by working each with his individual capital, have felt often the most keenly the abuse and unjust burdens heaped upon our companies by those who seem to have no conception of what a corporation is, or why corporations are formed."

Mr. Watson then made the following interesting reference to the valuable public services which street cars can render apart from their regular vocation of carrying passengers: "Since the introduction of cable and electric transit, the government has found a new use for the street cars. Some of our lines have been elevated to the dignity of United States mail routes. The plan is to place on all cars convenient little boxes for the collection of mail, which is taken up and sorted at some central point, and the city letters sent to the sub-stations without any of the delays incidental to the handling of the mails at the general post office. As an illustration of the working of such a system, there is on record a well authenticated instance of the travels of two letters, one of which was dropped into a letter box on a lamp post in a large city, and the other sent from the same point at the same time to the general post office on an electric car. A comparison of the envelopes, subsequently made, showed that the second letter actually reached Washington, 400 miles away, at almost the same time that the letter dropped into the box was received at the general post office, only two miles distant. In a city where all the cars come to a common centre the plan seems most feasible, and companies who have not given this matter due consideration will do well to consult their local postal authorities at an early day."

The World's Columbian Exposition was referred to by Mr. Watson as follows: "No doubt we shall all derive much pleasure and reap great benefit from the Columbian Exposition in Chicago in 1893. It will be learned with no little regret that Mr. Charles B. Holmes has resigned from the World's Fair Committee. Mr. John B. Parsons, of the West Chicago Street Railway has been asked to fill the vacancy, and happily for us he has accepted the appointment. But we shall not have to wait two years to yet to learn what the inventors and manufacturers are doing. They are here with us in large numbers, and their exhibits are well worthy of a large share of your time and attention in the intervals of our business meetings."

The president concluded his address by paying a well deserved tribute to the secretary of the association, Mr. William J. Richardson. He thought that they had been most fortunate in having so many years in office a gentleman so earnest and efficient in the discharge of all the duties of this important position.

Finally, all journalists must have been well pleased with the eloquent compliment paid by Mr. Watson to the street railway press. "Never more eagerly than now," said he, "have we watched for the coming of these ever-welcome monthly visitors. The development of new forms of rapid transit has sent us back to school again, and these are our text books. From title page to back cover we scan them through, advertisements and all, in our eagerness to learn the very latest advances in electric, cable and other forms of motive power. They would do splendid missionary work in the editorial rooms of some of our leading daily papers, and the local companies would be acting wisely should they arrange to secure, at whatever cost, the exchange of their city papers with the several journals devoted to the street railway industry."

The executive committee presented a report in which it was stated that the membership was then 180 companies, and it was expected that at the close of the meeting it would probably exceed 200 companies. Among other points touched on in this report was the subject of "Fellow Workmen," on which the following very sensible remarks were made: "Comment was made a year since upon the fact that a number of mutual benefit associations had been organized among the employees of companies that are members of this association. We are pleased to note that considerable interest has been manifested by various companies during the year regarding these organizations, looking to the establishment of similar societies among their employees. The companies that have such societies under their patronage, and contribute to their support, know by experience how useful they are in bringing about and fostering pleasant relations between the managers and the men, whether in the office, upon the road, or in the shop. These mutual benefit associations tend to harmonize the interests of all, making all, employer, as well as employee, feel that they are fellow-workmen together. When the time shall arrive that the employees shall have vested interests in the business of the company, essential differences between employers and employees will no longer arise; for the interests of both will then be identical. We shall do well, as managers of great corporations, to do all that lies in our power to hasten the coming of that day."

The treasurer's report was presented and made a very satisfactory showing, there being a balance of $1,742 to the good.

A resolution was passed appointing a committee of five to obtain information and report on the character of engine that gives the best results in power plants for traction purposes.

Resolutions were also passed approving of the action of the Superintendent of Census in placing the collection of the statistics of electric railroads in the division of manufactures, in charge of Special Agent Allen R. Foote, and requesting Superintendent Porter to collect and report the complete statistics for electrical railroads down to the date of publication, and thus give to them their highest degree of value.

It was further resolved that a committee on census composed of five members be appointed by the association to represent it in an effort to secure ample provision and authority for a complete census of the electrical industries, and the association pledged itself to support all reasonable measures to that end.

A committee of seven was appointed on "Standardizing of Ratings, Nomenclature, Dimensions and Accounts for Electric Street Railways."

The officers of the Association for the year 1891-2 are:

President—John G. Holmes.
Vice-President—Thomas H. McLean.
Second Vice-President—James B. Speed.
Third Vice-President—Albion E. Lang.
Secretary and Treasurer—Wm. J. Richardson.

The next annual convention of the Association will be held at Cleveland.

A banquet at the Monongahela House, at which more than 500 guests were present, and some excellent speeches were made, formed a pleasant and fitting conclusion to a very memorable and successful convention.

Abstracts of the papers read at the convention, an account of the exhibition, and some general notes on various interesting features of the convention will be found in other parts of this issue.

ELECTRICITY

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Communications relating to subjects within the province of this journal are cordially invited. News notes, descriptions of new devices with drawings or photographs, are at all times desired.

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Entered at the Chicago Post Office as mail matter of the second class.

The Birth of The Dynamo. Under this title Mr. C. C. Randolph contributes to ELECTRICITY an article in which he describes a tour of observation through a large dynamo factory. Many there are who almost every day catch a glimpse of electrical machinery revolving in the basement of some large building or in a central station, and although they know that that machinery causes the arcs to gleam and the little filaments to glow, they have but the very vaguest idea of the why and the wherefore. Mr. Randolph tells them very clearly, and our artist lends admirable point to his descriptions, just how a dynamo is made, and how it is that copper wire and iron bars are combined into a machine which generates the serviceable electric current.

* * *

Condensed Reports. Some of our excellent contemporaries in the electrical field have a habit of announcing, previous to the gathering of important conventions, that in their next issue will be presented "a stenographic report of the proceedings." We question very much that the majority of their readers fully appreciate the enterprise which this announcement and its fulfilment are meant to display. At a conservative estimate it may be taken that nine out of ten readers of electrical journals do not care to take the trouble or to spend the time to wade through the "stenographic reports" of convention or other association proceedings. ELECTRICITY, therefore, has adopted the plan of presenting condensed reports of these proceedings, in the belief that abstracts of long papers, giving their salient points and general conclusions, will be read and appreciated by many who would unhesitatingly skip the same papers if printed at their full length.

The Street Railway Convention. In this issue the Convention of the American Street Railway Association has been treated in the manner referred to above. A brief review of the presidential address and of the general proceedings of the convention is presented, together with abstracts of the important electrical papers read. This treatment bring the present status of the street railway industry within the reach of every reader, whether he be a plain business man or a practical electrician, and no one can afford to ignore what is being done by electric traction today. In fact, the most remarkable phase of the street railway industry, as exemplified by the convention, is its prompt surrender to the electrical engineer. Barely four years ago the electrical engineer began to perceive that there was a good opening for him in street railway work. To-day he is operating the majority of the surface railways in the country, and it is pretty safe to say that in four years more he will be practically without a rival in the field. The car horse will be but a memory, and the cable will remain in possession of inclined planes only.

* * *

Will Chicago use Niagara's Power? In the columns of ELECTRICITY the project of transmitting power from Niagara Falls to Chicago has been treated of on various occasions. In a recent issue we gave the views of Mr. H. Ward Leonard on the subject; he stated as the result of his calculations that by using a pressure of 80,000 volts an efficiency of about fifty per cent. could be obtained at the receiving end, and that the cost of the plant and conductors would not prohibit the undertaking from being a commercial success if the installation were maintained permanently. In this issue a reference to this project will be found in our regular report of progress of the World's Fair Department of Electricity. Some of the engineers connected with the Lauffen-Frankfort experiment have communicated to Mr. Hornsby, of the Department, who is now in Germany, their desire to transmit from 1,000 to 5,000 horse-power from Niagara Falls to Chicago, using a pressure of 50,000 volts. If the work is to be undertaken at all, we should certainly like to see it done by American engineers, and now that foreign electricians are ventilating their plans, surely it is time that some of those at home should take up the scheme in earnest. It must be remembered that the Lauffen experiment has not taught us much about the practicability of high pressures after all. It was widely announced that the working pressure would be 30,000 volts, but from all reports that have come to hand it has never actually exceeded 16,000 volts. The Lauffen-Heilbronn plant, which is described in this isssue, is to be worked at a pressure of but 5,000 volts. There is a very wide difference between 16,000 volts and 80,000, or even 50,000, and it is very much to be questioned whether those who talk so easily about these very high pressures would not find them rather difficult to manage in actual practice.

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Underground Feeders. In Mr. Mansfield's report on electric traction he made a very good point by advising all street railway companies to put their feeder wires underground. It would be much easier, he argued, to approach local authorities in quest of franchises if the assurance were given that the only overhead wire would be the trolley wire itself. This is very sound advice. With the advances that have recently been made in the construction and maintenance of underground wires, and taking into consideration the present attitude of most cities and towns of any size on the overhead wire question, there is no excuse for any electrical company putting a single wire overhead that can possibly be put underground. If the companies will adopt the plan suggested by Mr. Mansfield they will find local authorities much easier to deal with and it will pay them well in the end.

* * *

Storage Battery Traction. The report of Mr. Knight Neftel on storage battery traction, read at the Street Railway Convention, did not tell us quite as much about the progress made in this direction as we should like to know. One very good reason is, of course, that there has been very little progress during the past year, but it has by no means been of such a negative character as to justify Mr. Mansfield's sweeping condemnation of the storage battery for traction purposes. He has "no faith in them and no hope for them." Others just as well, or even better, qualified to judge, have both faith and hope, and perhaps they might wish Mr. Mansfield a little charity in treating of their work. The storage battery has done good street car service, both in this country and abroad. In Birmingham, Eng., storage battery cars have been in operation for some time, and they have been found more economical than horse-cars by about 7 per cent. There is unquestionably a great future for the storage battery car in cities where overhead wires are not permissible, and we hope before very long to see the storage battery take its rightful place among methods of electric traction.

* * *

Something Tangible At Last. The public of New York City has at last had something tangible laid before it in the shape of plans for a rapid transit underground railway. The tunnel is to be only nine feet below the surface and yet the Commissioners say that the street will not be disturbed except for stations and air shafts. It is very easy to say so, but it would be safe to predict that the streets of New York will have a hard time of it while the tunnel is building. The principal objection to the whole scheme is its immense cost. As our New York correspondent points out, there is a very doubtful feeling as to the possibility of raising the neccessary capital. It will be noticed that the Commissioners make only a half-hearted recommendation of electricity as a motive power, although what other power could economically take its place and comply with the conditions of non-combustion and speed is not very evident.

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Insulating Materials. It is interesting to consider, in connection with the articles on insulation now publishing in ELECTRICITY, the growing difficulty of obtaining good insulating material. Gutta percha and india rubber are the two oldest insulating materials of industrial application. Gutta percha long ago reached a fabulous price, so much so that, bulk for bulk, it now costs as much as copper, and the material has become so scarce that almost the entire supply is taken up by the submarine cable companies in Europe. Rubber has been put to so many uses that its price has steadily gone up. Rubber is the basic material of all the insulating compounds used by insulated wire manufacturers in this country, and in the opinion of some very good authorities, vulcanized rubber is the material best capable of withstanding the strain of the high pressure currents which

are so much in vogue with electrical engineers to-day. A considerable rise in the price of the prime material, the aim of the "rubber trust" which we are promised every now and then, would therefore be a very unwelcome blow to the electrical industries. Fortunately, however, electrical engineers have other materials to fall back on for insulating their wires and cables. Paper, which serves so many purposes in so many industries, is, when perfectly dry, an excellent insulator. Dry paper is the only insulating material used in many cables now doing good service in this country. For telephone and telegraph work it has the additional advantage of low electrostatic capacity, the retarding effect on the transmission being less with dry paper than with any other kind of insulation. Paper also stands up well under heavy strains, and paper insulated cables for electric lighting have successfully withstood pressures of upwards of 11,000 volts. In London Mr. Ferranti is using cables insulated with paper impregnated with a wax compound, under a working pressure of 10,000 volts. Heavy oil is another good insulating material, and a very successful type of cable is made with an insulation composed of cheap fibrous material soaked in oil, the whole being enclosed in a leaden pipe, a necessary protection for all insulating materials which readily absorb moisture. In view of the increasing scarcity of gutta percha and india rubber, it is satisfactory to know that the electrical engineer is no longer entirely dependent on rubber gums for insulating materials.

THE BIRTH OF THE DYNAMO.*

BY CHARLES C. RANDOLPH.

Everybody who reads knows that wonderful strides have been made in recent years in the application of electricity. The evidences of this are to be found on every hand. We see cities and villages lighted by electricity, we see street cars propelled by it, we see printing presses and other machinery driven by it. That is as far as the knowledge of the masses goes with respect to this comparatively new industrial factor. Now let us see how the machine is built which furnishes the electrical energy to do all this useful work.

Ask the average man what a dynamo is and you begin to uncover his weakness. Ask him if he knows how the dynamo is made, or how many parts it has and what they are, and it is safe to wager that he will be unable to tell. It is the average man then that this sketch is designed to benefit. I shall try to treat the subject from a strictly non-professional standpoint. Doubtless the electrician who reads to the end will not question this intention.

The factory I selected in which to learn the why and the wherefore of the dynamo was that of the Eddy Electric Manufacturing Company, of Windsor, Conn. This company makes a specialty of the equipment of manufacturing establishments with electric power. Its factory is thoroughly well equipped with the best machinery and labor-saving devices, and its superintendent, Mr. George T. Briggs, is agreeable and willing to explain to the uninitiated the process of dynamo manufacture. He devoted two hours to me the other day and when I left him it seemed to me that a load of dense ignorance had been lifted from my shoulders.

Ninety men are employed by the Eddy Company, in a large three story brick building standing near the railroad depot in Windsor. Most of these are skilled mechanics and their work is divided into a number of departments. I began my tour of observation in the room devoted to the castings, where the iron frames of the field magnets—the foundation of the dynamo—are made. These castings are made of a special grade of soft iron. "They are of the ordinary horse shoe type," said Mr. Briggs. He referred to the casting in the condition in which it leaves this department of the factory. It takes three massive pieces of the metal to produce the likeness to the horse shoe. The two which form the sides are called by the electricians, limbs. The curved piece which joins them is termed the yoke. It will be well to keep these terms in mind.

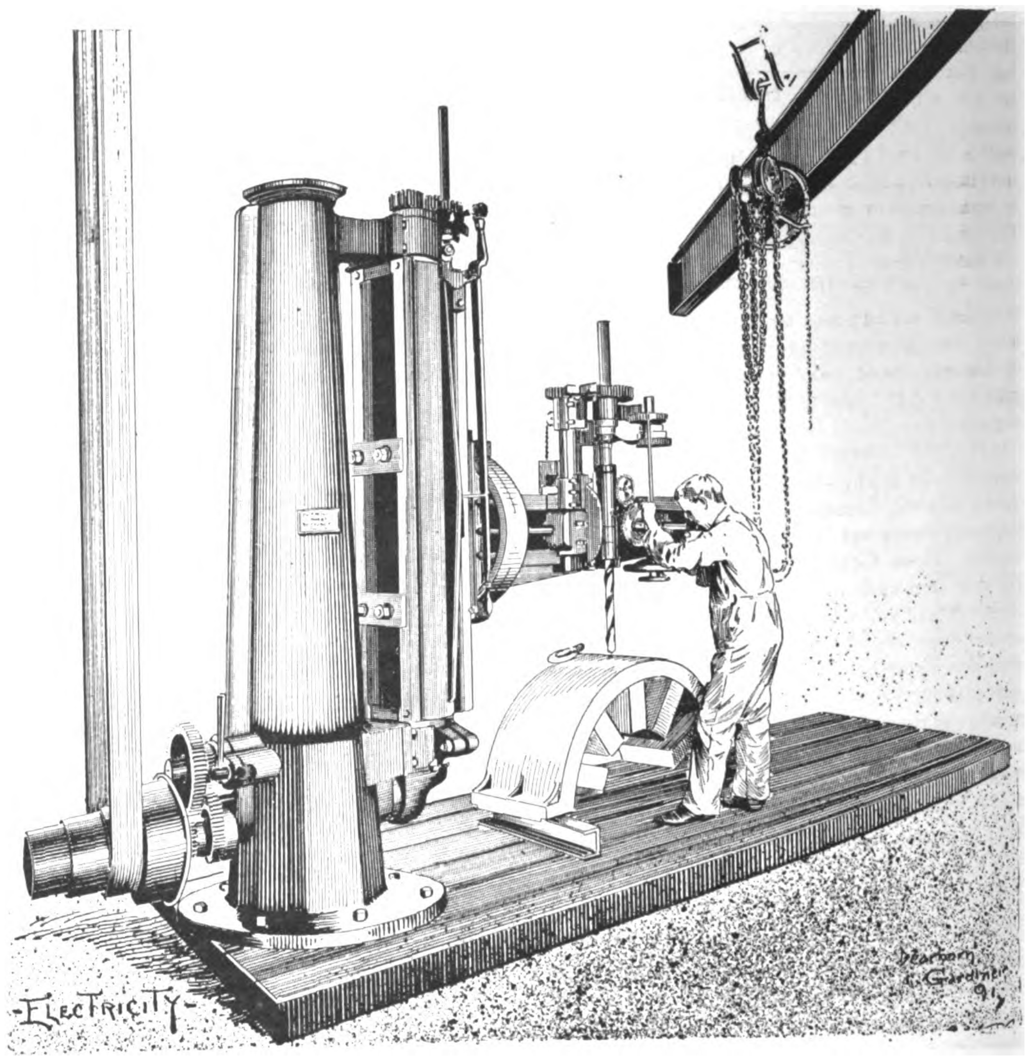
While I stood looking at the heavy pieces of iron, a workman picked up one by means of a travelling electric crane, which enables one man to raise six tons, and lowered it gently on a big planer capable of planing a piece of iron five feet square and fourteen feet long. He started the machine and the rough surface of the iron exposed to the knife gradually disappeared. Another limb was lifted and subjected to the same treatment. Then the yoke piece was planed so that it would accurately fit the limbs. The process did not take long, although the three pieces together weighed several tons.

A boring machine, a monster built to hold a piece of metal five feet in diameter, next received them. Four holes were bored through the yoke piece and in the limbs. Then four stout iron bolts made yoke and limbs one. Before they were bolted together, however, another feature of dynamo manufacture had to be attended to.

Not far from the castings a peculiar machine was at work. It was making the "field coils," without which a dynamo would be about as valuable as a horse with three legs. A glance at the picture of the completed dynamo will show the closely woven wire around the limbs of the machine. This is the field coil. When no current is passed through it the huge iron magnet, formidable as it looks, has no magnetic power, no attractive force. The moment a current circulates through the coil the field magnet becomes charged with magnetism, and there then exists in the neighborhood of the poles, that is, the free ends of the limbs, what is known as a "magnetic field." If a wire be brought within the influence of this magnetic field, an electric current will be developed in the wire. High efficiency in the dynamo requires a strong magnetic field. It follows that the field coil is an object of much solicitude to the manufacturers.

The basis of the coil is a vulcanized fibre spool which is designed to fit the limbs of the casting. This spool is first placed in the peculiar winding machine I have mentioned, which is provided with a screw feed. Copper wire of the required size is wound by this machine round the spool, the screw feed operating to produce uniform layers, no two turns of the wire crossing each other. Each layer is insulated from the next by heavy insulating paper. Great care is taken to make the insulation perfect. A single defect, resulting in a contact between two wires of different layers, would ruin the dynamo.

In order to follow the process without delay from this point, let us suppose that the field magnet castings have been painted and polished and set down in the "assembling room" of the establishment. Lest this term may be too technical, I will say that in this room all the component parts of the dynamo are put together. The travelling crane transports the different pieces from point to point as they are needed. Quick workmen bolt the limbs I have described to a base of wood, which is accurately shown in the illustration. This wood is kiln-dried birch and is very strong. Some of these bases weigh 400 or 500 pounds. The field coils are now slipped over the limbs and the yoke piece is bolted tightly into place. Now



Drilling the Frames of Field Magnets.

we see the resemblance to the horse shoe magnet with which every schoolboy is familiar. In its present form this part of the machine is a magnet; but, in spite of its size, a very weak one.

If you consult your dictionary you will find that the word "magnet" means a lodestone—a species of iron ore which has the property of attracting iron and some of its ores. As a matter of fact, and this may be news to many, all cast iron has this property to a greater or less degree. "All the castings that come to us have more or less magnetism," Mr. Briggs said to me. "Nature provides the initial power, limited though it may be, which makes the construction of the dynamo possible. With this power at his disposal man has found out how to develop and intensify it."

Before the iron limbs left the casting room their jaws or ends had been drilled to receive what are denominated studs—pieces of gun metal designed to support yokes of the same metal, which in turn hold the "armature." A study of the picture of the dynamo will aid largely in getting my meaning. Between the limbs of the wire-wound magnet you will see a cylinder extending several inches beyond them. The end piece holding this shaft is the yoke I have spoken of. You will observe that it is secured to the limbs of the magnet by round pieces of metal. These are the "studs." The cylinder is the armature.

Webster defines the word "armature" as follows: "A piece of soft iron used to connect the two poles of a magnet or electro-magnet, in order to complete the circuit or to receive and supply the magnetic force. In the ordinary horse shoe magnet it serves to prevent the dissipation of the magnetic force."

In the Eddy dynamo a hard steel shaft of small diameter rests in the yokes already described. On this are secured hundreds of thin plates of soft sheet iron, separated from each other by paper washers. These form the core of the armature. The sheet iron washers are each only thirty one-thousandths of an inch thick. The paper is tissue especially prepared for this purpose. At each end of the core a cast iron head, having a diameter equal to the external diameter of the washers, is threaded on the shaft. The washers are tightly compressed between the heads, thus making practically a solid cylinder several inches or more in diameter according to the power which the dynamo is calculated to develop. String a lot of pennies tightly together and you have the exact appearance of this part of the armature.

The armature is not yet ready to go into the dynamo. A good deal of careful work has yet to be done on it. After the washers are tightly compressed the cylinder is taken to what is called the armature winding room. Here a dozen men and women are at work. In a very short time the core is thoroughly insulated. The skillful fingers of the operatives make speedy work of what, to the novice, seems like an interminable job. The insulation consists of cotton cloth and insulating paper, which is impregnated with shellac and carefully fastened to the core by means of a solution of the same substance, forming a complete insulating covering to the armature core. After being thoroughly dried, the core is ready for another process, that of winding.

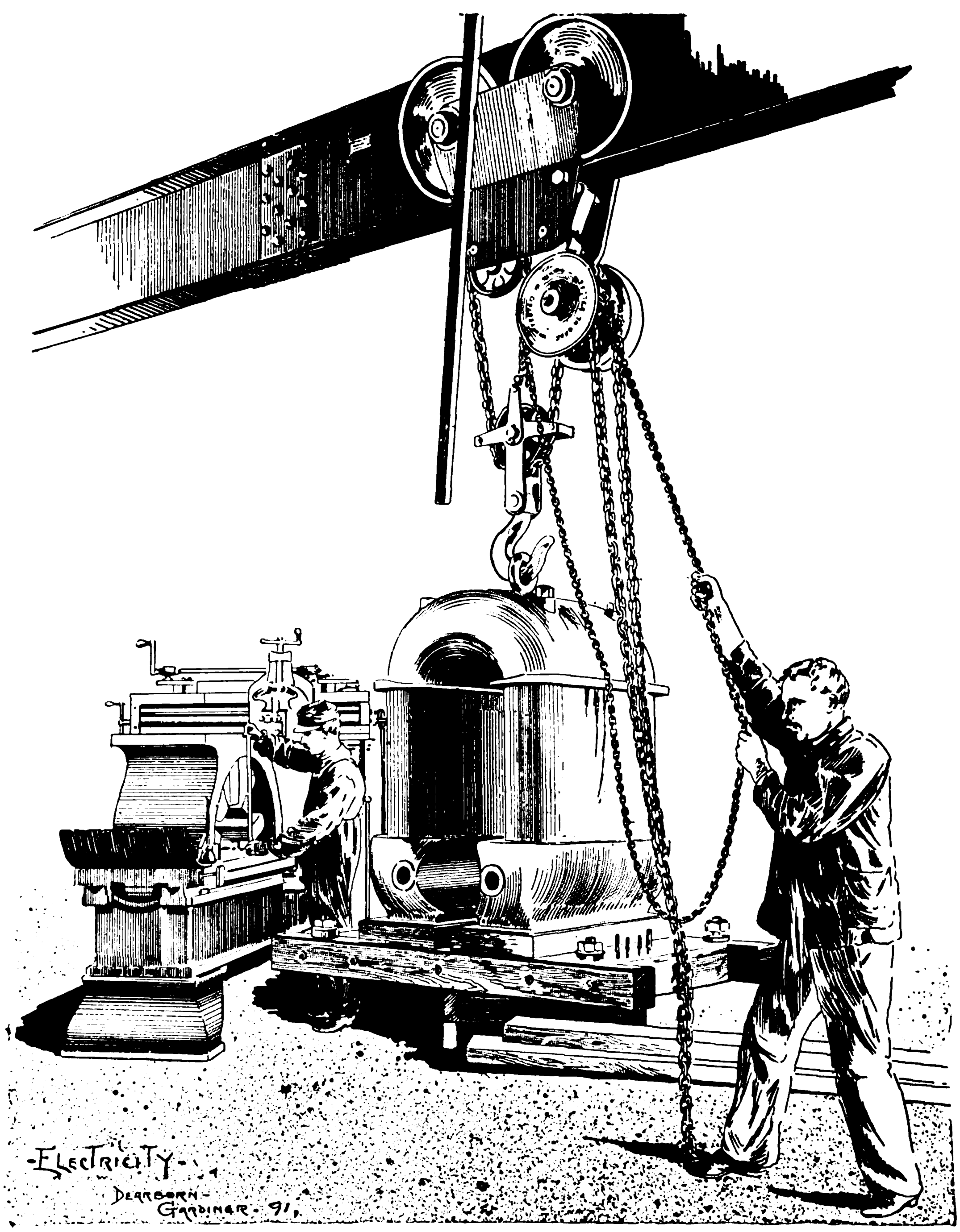
Each core, when it reaches this stage, is divided into a number of sections, from 36 to 100, according to the proposed power of the dynamo. Each section is wound with a certain number of coils of insulated copper wire. The winding is lengthwise, and is almost too intricate to be accurately described. This part of the work is about the most important detail of dynamo building, and is done with the most scrupulous care and nicety by highly trained operatives. It is all hand work, as no machine has yet been designed to supersede human skill in this delicate operation. After the winding of the armature is completed the wires are bound in place by a number of bands of phosphor-bronze wire. These are insulated from the windings of the core by strips of mica.

You now know that the armature is a solid steel shaft strung with alternate washers of soft iron and paper, and wound with insulated copper wire. It is simple enough when analyzed. Completed it is a wonderfully complicated looking affair. Now comes the "commutator," which has an ugly look to the inexperienced eye.

Webster thus defines the word "commutator." "A piece of apparatus used for reversing the direction of an electrical current; an attachment to certain electrical machines by means of which alternating currents are made to be continuous or to have the same direction." In the dynamo the commutator gives a uniform direction to the currents generated in the different coils. The armature, of course, is wound with a large number of separate coils. As each coil moves past one pole of the field magnet a current is generated in it in one direction, as it moves past the other pole the direction of this current is reversed, so that without the commutator the currents from the armature would be rapidly alternating in direction. As it is necessary for most purposes to have a continuous current in one direction, the commutator corrects this state of affairs and reverses one set of currents at each revolution of the armature so as to produce general harmony.

The commutator is a cylinder made up of a number of segments of hard copper, insulated from each other by mica sheets, the whole being held together by a gun-metal sleeve with a flange at one end. This sleeve passes through the commutator, the copper and mica segments being built up round it, bringing the flange tightly against one end of the segments. A nut and washer on the other end serve to hold the segments together. Both the flange and the nut are "recessed" at a sufficient angle, and the ends of the copper segments turned to the same angle, so that they are held firmly in place. Every segment is insulated from the next and from the gun-metal cylinder by mica, as it is highly necessary that there be no electrical contact between them.

The commutator is slipped on the armature shaft and the ends of the different coils of wire which were wound on the armature are carefully soldered to the copper segments. These ends are then covered with parchment to protect them and hold them in place. If you look at the picture of the dynamo, or examine the dynamo in some electric light factory, you will easily distin-



Planing and Fitting Field Magnet Frames.

WINDING FIELD MAGNET COILS.

guish the commutator. It is a handsome piece of work, made absolutely perfect by the methods employed in electrical machine factories.

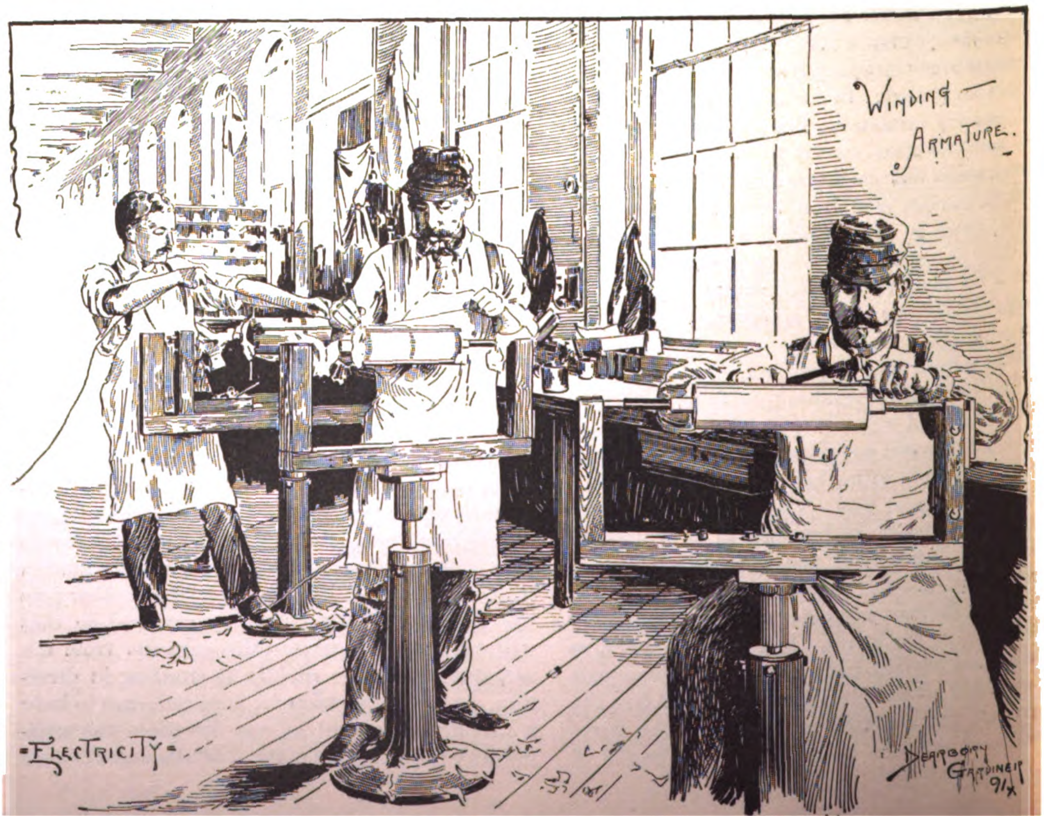
After the commutator is attached to the armature, that important part of the dynamo is taken to a grinding machine near by, where the bearing surfaces of its shaft are given a true cylindrical surface. After the grinding is over and while the cylinder is still revolving it is carefully rubbed with an oil stone. Then the armature is sent to the drying-room. There it remains thirty-six hours, at the expiration of which time it is ready to take its place in the embrace of the field magnets. It is pushed in between the jaws or poles of the magnet, and the shaft slides into the bearings.

The work of completing the attachments is quite simple. A pulley, which takes the power from the driving belt of the engine when the dynamo is at work, is adjusted to the end of the shaft furthest from the commutator and fastened by a key and nut. The "brushes" are then adjusted.

What are the brushes? Webster says they are "thin plates of metal used to conduct an electrical current to or from the commutator of a dynamo, electric motor or similar apparatus." The brushes are made up of strips of sheet copper, each from one-eighth to one-half inch in thickness. Their ends bear on diametrically opposite points of the commutator. In a nutshell, the object of the brushes is to collect the current generated by the dynamo so that it can be fed into the conducting wires and distributed. The current passes from the armature coils to the segments, from which it is taken up by the brushes, and by them it is delivered to the main wires to be used either for light or power. The buzzing sound inseparable from a dynamo in motion is due to the friction of the brushes upon the commutator.

We have traced the growth of the dynamo from the casting. It now stands before us a complete machine, its pulley ready to receive power from the belt of the engine, and convert it into all adaptable electrical energy. We have discovered how the various parts are created and combined, and we know something of what they are expected to perform. And yet there is a good deal of wonder concerning the work of the dynamo and how it does it. How can power come from a union of cast iron, copper wire, sheet iron and paper? I asked the question of Mr. Briggs, regardless of the shock I might inflict upon his scientific system. This is about what he said in reply: All the iron we use is, as I told you at the beginning of your inquiry, slightly magnetic. If if is not we magnetize it by means of a strong current. We are sure of a small quantity of residual magnetism in the iron frame of the magnet. This residual magnetism does the business. The engine is started, the rapid revolution of the armature which connects the two poles of the magnet, generates in it a current from the reserve fund, this current passes to the field coils, which are connected through a sort of by-path to the winding of the armature, and charges them to their full strength.

A powerful magnetic field is then created between the poles of the magnet, and as the armature is revolving in the very centre of this field, current is generated in the coils of the armature. Thus the two principal parts of the machine help each other. There is sufficient magnetism about the machine to cause the generation of current to begin directly the armature is revolved. A portion of this current goes to the coils of the field magnets and at once strengthens their magnetism, which naturally causes a corresponding increase of strength in the currents generated in the armature. In a very short time the magnetic field at-



tains its full strength and the dynamo is developing the full amount of energy for which it was designed. This, in a few words, is the beautiful principle of the self-exciting dynamo. Of the power supplied to the dynamo by the driving engine, it delivers about nine-tenths in the form of electrical energy, available for lighting, for driving motors, for electro-plating, for the reduction of ores, and for dozens of other useful purposes. A very small percentage of the power is used in the dynamo itself for energizing the field magnets.

The mechanical parts of the electric motor are the same as those of the dynamo. The winding is practically the same, with but few exceptions. The motor simply reconverts, to quote Mr. Briggs, "the electrical energy into mechanical energy and renders available for useful work the power which is driving the dynamo at the other end of the line." The electric motor is in no sense a prime mover, it is simply an element in a system for transmitting power.

CURRENT ELECTRICAL TOPICS.

It is stated that the Societa Elettrica Industriale, of Milan, Italy, are introducing a neat and simple arrangement of hand dynamos which can be used for a variety of purposes, such as lecture experiments, charging small accumulators, driving small motors etc. The dynamo in question is of the inverted magnet type. We may mention that in England Messrs. Austin & Myers, of Armley, near Leeds, have paid great attention to the production of small dynamos and motors with good results.

* * *

The relative cost of lighting in Madrid is shown in the following table, as compared with London:

	LONDON.	MADRID.
Petroleum	2 cents per pint.	10 cents per pint.
Gas	66 cents per 1000 cubic feet.	$2.25 per 1000 c. f.
Electricity	14 cts. per kilowatt hour.	25 cents per k. h.

The *Revista Minera* has recently devoted considerable space to the subject, and has endeavored to prove that electricity is at present the cheapest means of illumination in Madrid, and should be adopted on account of its economy. The *Revista Minera* thinks that a number of small supply stations in one town, would have a much larger chance of success than one large central supply station.

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At the end of 1890 there were 9492 subscribers to the telephone service in Switzerland, being an increase of 1486 over the number in 1889. The length of telephone lines at that time amounted to 4579 kilometres, being an increase of 656 kilometres during the year.

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The projectors of the elevated electric railroad between Milwaukee and Chicago are still negotiating with a number of capitalists, but no steps have yet been taken toward the actual building of the road. One man has offered to put $500,000 into the project, but the company will not make a start until money enough has been subscribed to carry the road to completion and give it a successful start. The capital stock of the company is $10,000,000 and it is incorporated under the name of the Inter-State Electric Railroad.

* * *

A young lady belonging to New York "society" has instituted a suit against the Edison Illuminating Company, of Newport, to recover the modest sum of $100,000 damages. The plaintiff was returning home from a ball at Newport, and as her carriage was passing the electric light engine of a temporary plant, the horses became unmanageable and dashed away. The plaintiff was severely injured and did not take any active part in the gayeties of Newport during the balance of the season.

A PERFECT ELECTRIC MOTOR.*

BY H. A EVERETT.

This paper covers the results of eight years' experience. In 1883 experiments were made with an electric car, as the opinion was that it was just the thing, and hopes were entertained that it would revolutionize travel the world over. A track was built a mile and a half long with an underground conduit, but the experiments were not successful. The first car worked well, giving a speed of twenty-two miles an hour, and running forward or backward with one or two loaded trailers with great ease. When the second car was running, however, the speed of both was reduced to about four miles an hour. Many trials were made before the proper method of transmitting the power from the motor to the car axles was found. Wire and manila rope and friction gears were failures. Finally the late Richard N. Allan suggested a system of cog gearing, which was put in and has proved so successful that it has been adopted by all the prominent electrical companies in this country.

After fifteen months of experimenting the conduit system was abandoned, although faith in electric traction still remained undiminished. Motors and storage batteries all over the country were examined, without satisfaction, and the first gleam of hope appeared with the operation of the Richmond Road by the overhead system.†

An electric motor of three years ago should hardly be compared with the motors manufactured to-day, and, on the other hand, a motor that is considered perfect, or nearly so, now, may be considered old-fashioned and obsolete within a much shorter period.

Many tests have been made with storage battery systems, but it seems that the successful application of storage batteries for street railway propulsion is as far off as ever. Almost all street railway men admit that the storage system, if successful, would be the ideal system, and all hope for its ultimate achievement; and in this age of progress it would be very short-sighted and bigoted to say that it will never come.

Returning to the motors, the author thought that the motors when first constructed were altogether too light, both mechanically and electrically, but these difficulties are being overcome very rapidly, as well as the serious difficulty of too rapid motion, which swelled the operating expenses very largely in maintaining the parts and replacing the gearing. The best motors are the most simple in the matter of the construction of the parts, and at the same time not consuming too much energy, so that in addition to being simple, they will also be economical. It would be an improvement if in all machines made, a better insulated wire were used, in both armatures and fields; a more trustworthy and positive fuse wire, one that would always burn out while still under the capacity of the motor, would also be a great improvement.

Mr. Everett expects, within a few years, as the motors are perfected and their armature speed reduced, to see a line of railway from New York to Chicago, run on a basis of not more than a two hour time table for the through trip, and giving a transportation rate impossible with the present motive power.

With regard to the best size of cars for street railway surface it has been found that on routes having a small patronage, where the earnings are under 20 cents per car mile run, it is unwise and undesirable to have a car exceeding twenty-one feet inside length, as it is much more economical to have trail cars when the traffic is heavy, rather than to be at the continuous daily expense of hauling a very large car of great weight.

Motors have been wonderfully perfected during the past year, and if similar progress is made during the coming year, a very satisfactory point in motor construction will be attained. At present the gearless motor is attracting general attention. Every construction company now has the single reduction motor in the market, which is certainly a wonderful achievement in advance of the late countershaft machines.

The price of street railway equipment, Mr. Everett thinks, is too high. The companies, instead of operating 4,000 motor cars, could be operating 40,000 within a very short time, if the price were brought down to a reasonable figure so that all companies could afford to purchase. It would also be desirable if the electrical companies would supply all extra parts at a price allowing a reasonable margin for profit.

The perfect electric street car should have a motor well protected in all its parts, so that it will be impossible to pick up nails, wire, or anything that would short circuit it; at the same time a motor must be properly ventilated to keep it from heating. The cover should be made so as to be easily removed. The armature should be of large diameter, with slow speed, and having wide, well-oiled bearings. The commutator should be large and the brushes easy of access. The insulation of the armature coils should be especially good. This is at present the weakest point in the motor. The controlling switch should be easily operated and the simpler it is made the better. Every care should be taken in its construction to guard against any disarrangement of parts. The rheostat is an important appliance and should be thoroughly protected from injury. It should only be cut in circuit when starting the car. Every motor should have a trustworthy fuse and every car should be equipped with the best lighting arrester obtainable. The car should have a lamp circuit with lamps liberally placed. With regard to the trolley wheel pole and stand, it is desirable to have a wheel capable of following the wire at any angle, with a trolley pole brittle enough to break should it become entangled in the wires, and a trolley spring rigid enough to give steady pressure on the wire, and so constructed that when the car is in the car house or going under a low bridge, the pole could come very close to the roof of the car, while flexible enough to give good pressure when the trolley has to be twenty-one or twenty-two feet high at the railway crossings.

One of the serious disadvantages to operators of electric roads is the expensive labor necessary in winding the armatures and fields, and this also applies to the high-priced mechanics who ought to be employed to attend to the machines. There is nothing gained by employing a cheap class of labor to handle an electrical equipment. The durability of the motor is a question which requires very careful attention. The single reduction motor, when properly looked after, ought to last for many years.

The car should be of moderate size, constructed with all modern conveniences, but without fancy decorations or any unnecessary display. Electric heaters are now used with general satisfaction in a number of places. Electric signal gongs are used on some cars and work well. It is very desirable that the electric companies should devote some time to the perfection of an electric brake to stop the car with the same power that runs it. This could be readily done and would be a satisfactory improvement. There is no reason, too, why an electric fare register cannot be made to work successfully.

In the course of his paper, Mr. Everett related the following incident which is certainly worth reproducing: "A gentleman largely interested in street railways made the remark that in the city

*Abstract of a report read at the American Street Railway Association Convention, Oct. 21, 1891.

† An interesting description of the opening of this pioneer electric railway, by Frank J. Sprague, the engineer in charge, appeared in ELECTRICITY for Sept. 9, 23 and 30.

of New York they would never permit the use of electric cars if accompanied by unsightly overhead wires. I asked him if it was quite consistent that so much objection should be made to a system which required but one copper wire, not exceeding three-eighths of an inch in diameter, with posts on either side of the street, 150 feet apart, not larger than an ordinary hitching post, after allowing on the street that beautiful structure, 'the New York Elevated Railway,' shutting out both light and air to the people on the street where the railway is operated? He candidly admitted that he did not know but that the elevated road was about as bad as the overhead wires."

In the discussion on Mr. Everett's paper, a delegate asked for the particulars of the cost of operating electric railways. Mr. F. S. Pearson, of the West End Railway Company, of Boston, spoke on this subject as follows:

"Our road has about 350 cars, equipped with electric motors. The expense of operation with horses is about twenty-five cents per car mile, including everything connected with the operation, fixed charges and track repairs. In Boston the cost of operation is quite as high compared with some other cities. You will find in many cities the cost of operation of horse cars is below twenty-five cents, but we pay a good price for labor on account of running our lines in the congested parts of the city, where we cannot get as much work out of a man as you can in other cities. This makes a greater cost of operation. The cost of operations with electric motors up to the present has been about twenty cents per car mile."

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The classification of this department has been finally completed, and is now in the hands of the printers. It has been changed but slightly from the classification published some months ago and all changes are in the interest of the department. The rules of the department governing exhibitors have been formulated, under the supervision of Chief Barrett, by Mr. Keller, and are now in the hands of the Director General for his approval. The prospectus of the department has been completed, and is also in the hands of the Director General for approval, from whom it will go to the Committee on Electricity. It contains all information that it is thought anyone could desire and will aid intending exhibitors in determining the probable cost of their exhibit.

A recent letter from Secretary Hornsby, written in Frankfort, states that he left for Nuremburg on the 7th inst. to visit Schuckert & Co. From there he goes to Berlin, Cologne, Breslau, Dresden, Vienna, Buda-Pesth, Paris and London, to visit the works of the most prominent manufacturers who were represented at the exposition. He has been sufficiently encouraged there to visit these places. He is already assured of a number of extensive and complete exhibits. Hartman & Braun, of Bockenheim, state that they will make a magnificent display of their justly celebrated electrical instruments. Dr. Hœpfner, the well known electrochemist of Giessen, was visited and promised a complete exhibit of his method of electrolytic extraction and purification of copper and other metals. Dr. Werner Siemens has expressed a willingness to make a fine exhibit.

Prof. Ferraris of Turin, Italy, wishes to visit the Fair and the Electrical Congress especially. He says that he hopes the date for the congress will be fixed for August '93 as all of the professors of Europe have their vacation during that month and a better attendance could be had.

Frederick August Haselwonder, so prominently connected with the Lauffen transmission scheme, promises to exhibit a wonderful street railway conduit. He has made, in connection with Michael von Doliva-Dobrowolsky, of the same enterprise, an assertion that they are ready to transmit 1000 to 5000 h. p. from Niagara to the World's Fair at a pressure of 50,000 volts, using bare overhead conductors. The Ganz Co., of Vienna, talk of running an electric road from the exposition grounds to St. Louis, making the run every half hour.

A number of letters, giving information as to the existence and whereabouts of interesting historical apparatus and relics to be gathered in the historical section, have been received by Mr. E. E. Keller, and it is hoped that all persons having such apparatus, or knowing of its existence, will correspond with him.

Two Edison 50-light arc dynamos were placed in position in the temporary electric light station this week. The wires have been strung and a number of lamps have been placed in the different buildings. By the light of these arc lamps, iron work on the manufacturing building has been carried on long into the night. It is expected that the other buildings will be wired and arc lights be installed so that two gangs of workmen can be employed.

The strike among the men employed in the construction of the electricity building was, as predicted, of short duration; enough laborers were found among the unemployed men of the city to fill the places of the strikers.

A smoke stack 100 feet high and 52 inches in diameter is being erected at the electric light station by the National Boiler Works Co., of Chicago. The one in use at present was found incapable of producing the draft necessary to generate the power required by the additional dynamos.

Electrical Engineer Sargent says that the plan for the interior lighting of the buildings is well advanced and will soon be submitted for approval to the Department of Electricity and the committee on electrical appliances.

A general meeting of the sub-committee on scientific and philosophical congresses at the World's Fair was held last Saturday. The business to be transacted by each committee was gone over, and a thorough discussion of the work to be accomplished took place. The committee on electricity was represented by Robert C. Clowry, B. E. Sunny and Geo. H. Bliss.

The Edison General Electrical Co. have applied for 35,000 feet of floor space to exhibit the many inventions of Mr. Edison. The space asked for is a little over one-seventh of the total area of the Electricity building, exclusive of the galleries. In making his application for space Mr. Edison admitted to Chief Barrett that he was asking for a large section of the building, but added that every inch would be put to good use. "I shall not waste a foot of the area assigned to me, but will present a series of the most interesting electrical inventions ever produced," he said. "I happen to know," Professor Barrett added, "that Mr. Edison is doing just as he says. He is making an almost innumerable list of novel and spectacular exhibits."

THE CLEVELAND ELECTRIC CLUB.

A well attended meeting of men interested in electrical matters was held lately at Cleveland with the object of forming a club or society. Mr. C. W. Watson occupied the chair, and Mr. S. D. Nesmith, the secretary *pro tem.*, was on hand armed with the information necessary to organization. The constitution provides that the name of the organization shall be the "Electric Club of Cleveland." The objects of the club are "to provide the members with opportunities and means for the study and discussion of electrical subjects; to promote social intercourse among those interested, and to provide them with the conveniences of a club house." Any person interested in electricity may become a member. The initiation fee was fixed at $10 and the annual dues will be $20. After the constitution had been adopted, Mr. Nesmith was elected treasurer *pro tem.*, and those present signed the membership roll and paid the entrance fee. The election of officers for the ensuing year will take place shortly.

THE WISCONSIN ELECTRIC CLUB.

The Wisconsin Electric Club has guaranteed to make good any deficit that may exist after the closing of the course of lectures that is to be given in Milwaukee. Prof. Loomis, of the University of Wisconsin, will have charge of the course, which has been divided into three sections. The following subjects will be treated in the course on electricity: "Electrostatic Induction," "The Electric Current," "The Electro Magnet," "Electro-Magnetic Induction," "The Dynamo and Motor," and "Electric Discharges in Vacuo." The lectures are to be given under the auspices of the Wisconsin Electric Club, and it is their intention, if the necessary money can be secured, to have them delivered in different sections of the city, so that all who wish may attend.

THE DEPENDENT—STORAGE OR PRIMARY BATTERY—SYSTEM OF ELECTRIC TRACTION.*

BY KNIGHT NEFTEL.

So far, primary batteries have been applied only to the operation of the smallest stationary motors. Their application to traction may be entirely disregarded.

The application of secondary, or storage batteries, to electrical traction has been accomplished in a number of cities, with varying success. Roads equipped with batteries have now been sufficiently long in operation to allow us to draw some conclusions as to the practical results obtained and what is possible in the near future. The experience obtained on Madison avenue in New York, Dubuque, Iowa, Washington, D. C., and elsewhere, may be summarized as follows.

First. The independent feature of the system. The cars are independent of each other; free from such drawbacks as broken trolley wires, temporary stoppages at the power station, the grounding of one motor affecting other motors, and sudden and severe strains upon the machinery at the power station, such as frequently occur in direct systems. The absence of all street structures and of the loss by grounds and leakages are also very considerable advantages, both as to economy and satisfaction in operation.

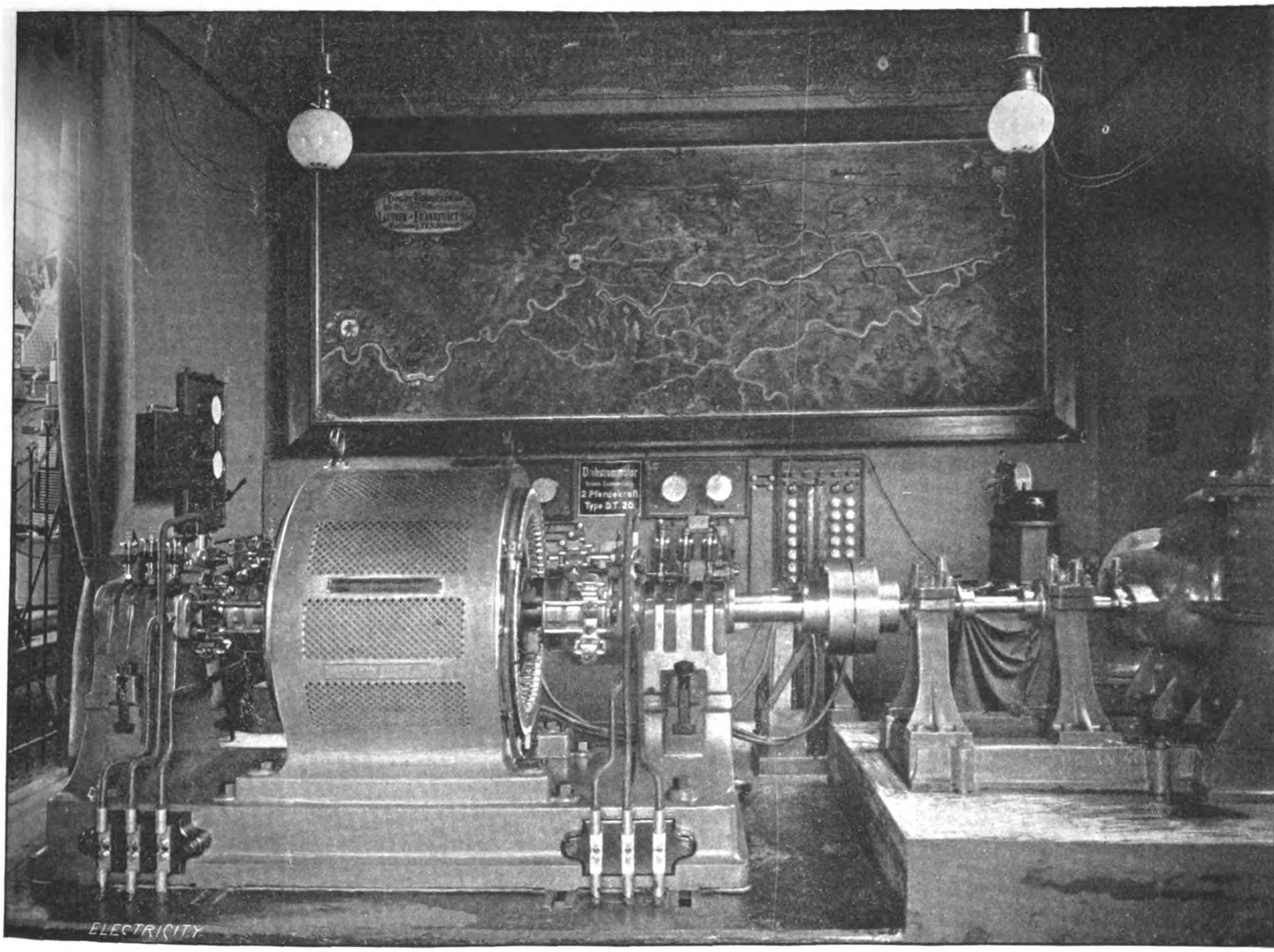
Second. The comparatively small space required for the power station. Each car being provided with two or more sets of batteries, they can be charged at a uniform rate without undue strain on the machinery of the power station, and as this can be done more rapidly than the discharge required for the operation of the motors, a less amount of general machinery is necessary for a given amount of work. Another important advantage of the system is the low pressure of the current used to supply the motors, which secures increased durability of the motor.

It has been demonstrated also that the cars can be easily handled in the street, they can be run at any desired speed, and reversed with far more safety to the armature of the motor than in the direct system. The increased weight simply requires more brake leverage.

The modern battery, improved in many of its details during the last year, has still an unknown quantity in its durability. There is the same doubt concerning this as there was with incandescent lamps when they were first introduced. At that time, some phenomenal records were made

*Abstract of a paper read at the American Street Railway Association Convention, October 23, 1891.

by lamps grouped with other lamps. Similarly, some plates appeared to be almost indestructible while others, made practically in the same manner, deteriorate within a very short time. It is consequently very difficult to exactly and fairly place a limit on the life of positive plates. Speaking simply from observation of a large number of plates of various kinds, I am inclined to put the limit at about eight months; though it is claimed by some of the more prominent manufacturers—and undoubtedly it is true in special cases—that entire elements have lasted ten months, and even longer. It must be remembered, however, that the jolting and handling to which these batteries are subjected in traction work increases the tendency to disintegrate, buckle and short circuit; therefore the durability of batteries in constant motion can never be the same as in stationary work.



THE "DREHSTROM" MOTOR AT FRANKFORT.

A serious inconvenience to the use of batteries in traction work is the necessary presence of the liquid in the jars. This causes the whole equipment to be somewhat cumbersome, and unless arranged with great care, a source of considerable annoyance. The connections between the plates, which formerly gave so much trouble by breaking off, have been perfected so as to prevent this difficulty, and the shape of the jars has been designed to prevent the spilling of the acid while the car is running. The car seats are now practically hermetically sealed, so that the escaping gases are not offensive to the passengers.

The handling of the batteries is an exceedingly important consideration. Many devices have been invented to render this easy and cheap. I have witnessed the changing of batteries in a car, one set being taken out and a charged set substituted by four men in the short space of three minutes. This is accomplished by electrical elevators, which move the batteries opposite the car, and upon the platforms of which the discharged elements are again charged.

The general conclusions which the year's experience and progress have afforded us an opportunity to make, may be summarized as follows: Storage battery cars are as yet applicable only to those roads which are practically level and on which the direct system or cable traction cannot be used; and they are applicable to these roads only at about the same cost as horse traction. I feel justified in making this statement in view of the guarantees which some of the more prominent manufacturers of batteries are willing to enter into, and which practically insure the customer against loss due to the deterioration of plates, leaving the question of the responsibility of the company the only one for him to look into

ELECTRICAL TRANSMISSION OF POWER BETWEEN LAUFFEN AND HEILBRONN, GERMANY.

BY FRANK C. PERKINS.

This plant will not be an experiment like the transmission between Lauffen and Frankfort, but will be a permanent commercial plant. Already 1,000 incandescent lamps, twenty-five arc lamps and seven electric motors have been contracted for by the citizens of Heilbronn, and the company installing the plant is under contract to finish it before the end of November of this year.

A charter has been granted by the city of Heilbronn to the Portland Cement Works, of Lauffen, to furnish electric current for light and power to the citizens of Heilbronn. This company's works are situated about seven or eight miles from Heilbronn, and at these works the generators will be installed. The total water power at their disposal is about 1,500 horse-power, of which 900 h. p. will be used to furnish power for the electrical machinery and 600 h. p. will be used by the Cement Works.

The station will be provided with the so called "Drehstrom" machines, giving multiple-phase alternating currents. This will be the first commercial plant to be equipped with this type of apparatus. The machines at Lauffen will be those that are now being used in the power transmission from Lauffen to Frankfort. The accompanying views show the generators at Lauffen and the motor at Frankfort.

The size of the wire in the Lauffen-Frankfort experiment is 4 m. m. The wire to be used in the Lauffen-Heilbronn plant will be 6 m. m. in diameter. In the Lauffen-Frankfort transmission the total loss on the line, between transformers, is calculated at 10 per cent., the loss in the generator at 10 per cent., transformers each 4 per cent. and motor about 10 per cent., making a net efficiency of 66 per cent. from Lauffen to Frankfort, 300 h. p. delivered at generators at Lauffen developing 200 h. p. at Frankfort. These figures are only estimates and actual figures cannot be obtained until after the official test, which will be made very shortly. The Lauffen-Heilbronn plant will be worked at a potential of 5,000 volts. In the

Lauffen-Frankfort experiment it is from 16,000 to 25,000 volts. The estimated total loss on the line from Lauffen to Heilbronn between transformers will be about 18 per cent., working at 5,000 volts and with conductors 6 m. m. in diameter.

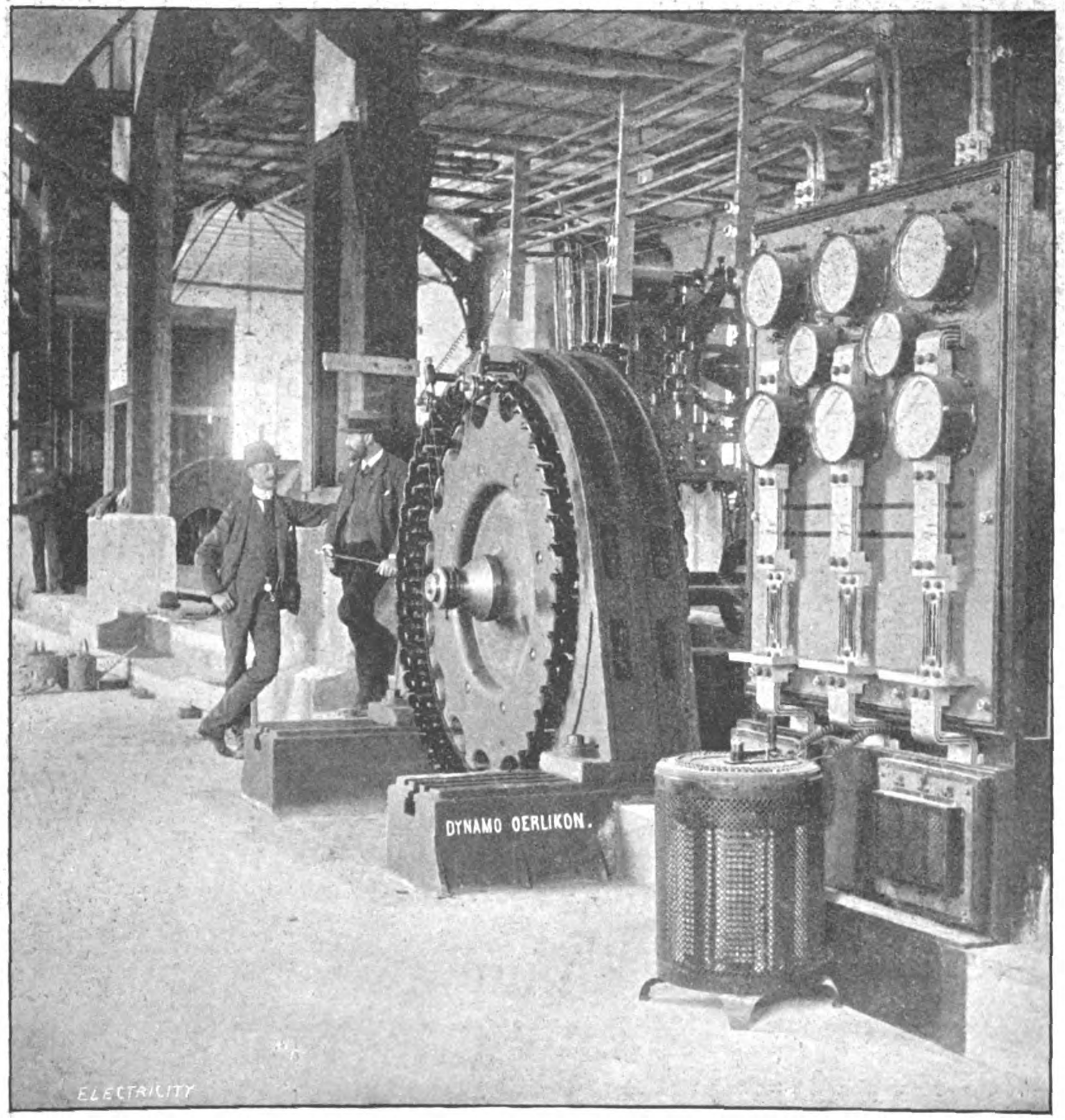
To begin with, only one of the three turbines now installed will be used for driving the generator. These turbines are each of 300 h. p. and were built by Geislinger Maschinen Fabrik. The dynamos and transformers were built by the Oerlikon Works, of Zurich, the wires and cables by Siemens and Halske, Berlin, and the switches and regulating apparatus by the Allegemeinen Electricitats Gesellschaft, of Berlin.

The current developed by the Drehstrom generating machines at Lauffen is 4,000 amperes at 50 volts pressure and is transformed to 39 amperes at 5,000 volts pressure. This transformation is to be preferred to building machines which develop directly at high potential, because the machines giving low potential are not only more easily insulated and safer to handle, but have a much higher capacity than those designed to furnish high pressure currents. So that, although a loss of about 3 per cent. is incurred by the transformations, it is more than compensated for by the increased capacity of the machines.

From the step-up transformer the circuit to Heilbronn is made up of three bare copper wires 6 m. m. in diameter. The insulators are of porcelain having cups filled with oil. The poles are from 26 to 45 feet high and the cross arms must be at least three feet above the tops of the highest trees along the road. A noticeable point about these poles is that on each is painted in red a skull and cross bones surmounting a warning not to touch.

The transformer station is just outside the city limits of Heilbronn and here the overhead wires end, the remaining circuits to Heilbronn and the distribution in the city being made by underground cables. The current is transformed from 5,000 volts to 1,500 volts, and this pressure is used on the main lines in the city. On these circuits are placed secondary transformers which reduce the potential from 1,500 volts to 100 volts. From these transformers the wires lead to the consumers' lamps or motors.

It is expected that 160 kilowatts of energy will be delivered to the consumers in Heilbronn from 200 kilowatts generated at Lauffen. This current will supply an installation of 4,200 16 c. p. lamps, allowing for 3,200 lamps burning at one time. The total cost of the plant, including water power and land, will not exceed $95,000.



Oerlikon Dynamo at Lauffen.

THE DEPENDENT—OVERHEAD OR UNDERGROUND—SYSTEM OF ELECTRIC TRACTION.*

BY GEO. W. MANSFIELD.

The various applications of electricity to railway work are divided into four methods: First, the underground; second, the surface; third, the overhead and fourth, the storage battery.

With regard to the underground system proper Mr. Mansfield thought that although much money had been spent and many experiments made, no solution of the problem had yet been arrived at. The main difficulty is in the insulation of the underground conductor. All sorts of methods have been devised for protecting the conductor and maintaining the insulation, but all of them fail under the crucial test of a conduit flooded with mud and water. Numerous ingenious schemes have been elaborated to overcome this fatal weakness, but it appears to-day that there is no hope in this direction.

The systems employing the surface method are somewhat similar to the conduit devices. In the majority of the surface systems there is an underground insulated conductor which is only available for picking up current at fixed points. The same trouble of defective insulation comes in here, as if the street is wet the circuit will be grounded at the contact points whenever they are made "alive" by the passage of the car. A combination of the two systems obviates many of the disadvantages of both. If the contact points are placed in protected positions and the contact bar or plow of the car operates them by passing through a conduit at one side of the boxes, the principal weakness of underground and surface systems – bad insulation—is done away with.*

"Summing up the general results of the underground and surface methods," continued Mr. Mansfield, "it certainly looks as if we could not expect very much from them in the immediate future. Much perseverence and money must be expended before as practical and certain a method as our present overhead method is attained. We surely are all anxiously and hopefully waiting for it. In behalf of the struggling inventors and our common good, I beg that you, gentlemen, will expend all of the above two items you possibly can.

Our rival is the cable. It certainly does look as if for the enormous sums they expend in making their systems feasible, we ought, for an equal sum, to make ours perfect. Mechanically it is an assured success, but electrically it has not so proven.

Is it not possible for some bright inventor to devise a scheme whereby the insulation of the live parts can be maintained? This is the sum of all the difficulties. A simple transposition of parts and the problem may be solved. Picture the result! No wires overhead. A welcome boon to millions of pent-up suffering people in the great cities of our country; the almost complete annihilation of our rival, and electricity forever established as the great transportation agent throughout the length and breadth of our land. Personally, gentlemen, I have large holdings of a ten per cent., cumulative, preferred hope, and I sincerely trust you all will subscribe liberally, if you have not already done so."

Coming to the third, or overhead method, Mr. Mansfield proceeded to describe the arrangement of the trolley wire. The wire may be either continuous or divided into sections. The sectional trolley wire must be used for city work, as the system is always of gradual growth. The methods of feeding the trolley wire of course vary as the wire is continuous or sectional. If continuous, the feeders are either extended from the station the entire length of the line, tapping into the line at intervals, or else separate feeders are run out from the station to certain pre-determined distances, and there tapped into the trolley wire; with the sectional trolley wire the feeder is tapped on either at the centre of each section or at both ends of each section. The question of feeder wires is one of great importance and difficult to always economically solve for all conditions. The point which the railway corporations should watch above all others is that they have enough. In many roads the larger part of the trouble has been that they did not have either sufficient trolley wire or track feeders. The ground connection is a very important point also, and much trouble is often caused by an inefficient ground connection. In large cities all feeders should be placed underground. The cities in which this underground work has been adopted are Buffalo, Minneapolis and St. Paul. Mr. Mansfield believes that the

*Abstract of a paper read at the Street Railway Association Convention, Oct. 22, 1891.

*A system of this class was described in Electricity for October 7.

trolley wire system is here to stay for many decades, and although he hopes for a successful underground system he thinks that it may never come.

He strongly urges the placing of all wires but the trolley wire underground. The cables alone will cost in all probability less than the overhead wires, and the construction work can be done simultaneously with the track reconstruction. Under these circumstances the additional cost of the conduits or ducts should not exceed a few thousand dollars per mile.

Too much care and attention cannot be bestowed on the overhead devices and material used. It does not pay to put in some little cheap fifteen cent arrangement, when for fifty or sixty cents a substantial, reliable and standard device can be obtained. It is also well to consider the question of uniformity in the apparatus. The only part that is liable to deterioration is the insulation material. Make this, therefore, of a uniform pattern and arrange the various holders for its reception. With such a system nothing can fall and the insulation is maintained easily and perfectly. It would be like renewing a glass insulator on a telegraph pole. The trolley wire should be of hard drawn copper, and No. O, B. & S. is the standard size. In regard to the wear, the universal testimony is that it is exceedingly slight. What wear is observable is found to be at the switches or on the curves. Serious mistakes have been made in the past by using iron flanged trolley wheels. These cut the trolley wire badly. Everything should be done to throw all the wear on the trolley wheels. These are much less expensive than wire, and not so hazardous for the public if they give out.

The life of the trolley wire is much longer than had been originally anticipated. The criterion is not the time that it has been up, but the number of times the trolley wheels have passed over it. It would seem that with the ordinary brass trolley wheel the wear was about .001 of an inch to the passage of 65,000 cars. This is at the rate of one in every six minutes, for eighteen hours per day, for one year. With only this wear the life of the wire would certainly be twenty years, unless through some process of crystallization it became more brittle. Undoubtedly, at curves and on switches the wear is somewhat greater. The breaking of the trolley wire has been rare, the breaks occurring either at splices, or switches, or were due to some extraneous cause, such as falling trees, telephone poles or the catching of the trolley pole. One road reports a break as due to the striking of the trolley wire by a locomotive smoke-stack. In no instance was any casualty reported, excepting in one case where a mule was killed.

With regard to loads carried and general conditions of working, the following are some of the details reported by a number of roads: The average speed of all the roads is 8.7 miles per hour. The maximum is thirty. The average grade is 6.7 per cent. and but twelve roads report as having none, or very small ones. The maximum grade is thirteen and a half per cent., and this extends for 1,500 feet. The road suffering from such an infliction is in Amsterdam, N. Y. Thirteen roads report ten per cent. or over. Nashville, Tenn., reports an eleven and a half per cent. grade for 1,300 feet, and Burlington, Ia., an eight and a half per cent. for 1,500 feet, while Wilmington, Del., reports a seven and a half per cent. for 3,000 feet.

The loads carried up these grades by two fifteen h. p. motors are, to say the least, surprising. Amsterdam reports one motor car and fifty-two passengers. Nashville reports one motor car and seventy-seven grown passengers. Burlington one motor car and seventy-five passengers and Wilmington, Del., reports one motor car towing a disabled motor car. Several roads report as towing one car with both full of passengers up eight and even nine per cent. grades, but for short distances. Auburn, N. Y., reports as having towed five cars all loaded, with one motor car. The grades in this instance were slight. In all these instances unquestionably the motors were exerting power considerably beyond their rated capacity. Trains carrying 350 passengers have been moved by two fifteen h. p. motors; a load of 200 passengers is an every day occurrence. Surely this is approaching steam railway practice. Such information is certainly useful to the electrical manufacturing companies.

Mr. Mansfield deplored the neglect of systematic testing of electric railway systems by their managers. There is nothing more essential to an electric railway than a first-class voltmeter, ammeter, galvanometer, and, if possible, a wattmeter. Electric light, telegraph and telephone, and all other electrical companies are supplied with necessary testing instruments, and in most instances a rigid system is maintained. Every railway company should be continually testing its circuits, station and cars for leaks or grounds. In this way only can they avoid trouble and consequent damage. "I advise, urge and beseech every company to supply itself with these instruments, and to put them into the hands of a competent person, or if they can afford it, a thorough electrician."

With regard to accidents, Mr. Mansfield said that not one road reported as killed, or even seriously injured, an employee or passenger by the electric current, or falling trolley or span wire. Several reported employees as receiving shocks, and one the case of a boy throwing a wire over the trolley wire and receiving the full potential without harm. None, however, was seriously injured. Several accidents are reported of collision and running over, but these cannot be entirely avoided and are inherent to any system.

Asked to give their opinion as to the reliability, permanency and safety of the electric system, all but one reported most emphatically in its praise. This one preferred horses. Further evidence on this point is shown by the fact that forty-four roads reported as never having been stopped by any cause, twenty-three were forced to stop because of the steam plant, failure of water, floods or fire, and twenty-six from electrical troubles, the main cause of these troubles being lightning.

Touching on storage batteries Mr. Mansfield had nothing good to say of them; he has no faith in them nor hope for them. He thinks that there are some grounds for hope in the direction of an underground or surface system. There is univeral praise on every side for the overhead system. Six thousand and seven hundred cars operated over 3,000 miles of track in the streets of full 300 of our towns and cities, surely testify to its merits and value. Of this number of towns and cities fully one-third have absolutely no other means of transportation. What objections there are, are on purely sentimental grounds. Given a city with all wires under ground, where would be the objection to iron poles and a single wire for each track? The rails themselves would be a thousand times more objectionable and dangerous. The benefits to come from its introduction are incalculable. In the words of Parnell, "Hold on, fight on. A magnificent future is before you." The wonderful and marvelous development of the past is not to stop, but inevitably must continue. Electric railroading, city, town and suburban, is here for our upbuilding and natural prosperity as surely as steam railroading was fifty years ago. There are equally great opportunities for fame and fortune with this new agent as with the old. Let there be no uncertainty, no hesitancy.

The United States Rapid-Transit company, with a capital stock of $5,000,000, is a new Chicago enterprise. It is the intention of the organization to construct a series of overhead wires or cables for the rapid transmission of mail matter and merchandise. The motive power will be electricity.

SOME NOTES ON INSULATION*.

BY HERBERT LAWS WEBB.

When we come to consider the insulation of electric light mains for currents of high potential and low, of dynamos and transformers, of arc and incandescent lamps and of accessory apparatus for electric lighting, a number of interesting points are brought out.

Electrical engineers nowadays are chiefly absorbed in discussing the problem of providing efficient insulation for high pressure currents, as the tendency is to work with higher and still higher potentials, with a view to extending the limit of distance to which current can be economically transmitted from the generating station. It is not so very long ago that the insulation for the systems of distribution of low tension direct supply was being discussed with almost as much vigor, but the difficulties of confining a current at a pressure of one or two hundred volts to its legitimate channels pale into insignificance when it becomes a question of employing a potential ten, twenty, thirty, and even three hundred times as high as the lower figure.

It must here be borne in mind that the stress on the insulation increases not directly as the potential but as the square of the potential, so that with a potential of 2,000 volts there is a stress on the insulation not simply 20 times greater than with a potential of 100 volts, but 400 times greater. The insulation of high potentials, therefore, is a more serious undertaking than it would appear to be to casual observer who only takes into account the difference in the number of volts.

To draw a general line of demarcation between the insulation of low and high pressure systems of distribution it may be said that in the first we must insulate against the danger of fire, and in the second we must insulate against danger of fire and danger to human life. In the first system the stress on the insulation is, comparatively speaking, so slight that the quality and thickness of the insulating material employed are not of such high importance as the necessity of maintaining the continuity of the insulation at all points in order to avoid the risk of fire. The danger of breaking down the insulation is not so much within as without. The potential is not sufficiently high to break down any reasonably good insulating material, but mechanical injury, or the inroads of moisture, will cause damage sufficient to provide an easy path for the current, and hundreds of horse power of electrical energy are ready to struggle through the gap and demolish anything combustible within reach.

But the low pressure current is not always striving to burst its bonds and only does so when tempted by defective insulation, generally the result either of mechanical injury or poor work. Hence we find that in low pressure mains, in which the potential is only one or two hundred volts, a comparatively cheap quality of insulating material can be used, which would be entirely inadmissible if the pressure were, say 1,000 volts. In this country almost the only low tension system of electric lighting in general use is the Edison system, and the iron tubes which are familiar objects in almost every city in the States contain three conductors insulated from each other by a compound of which the principal material is bitumen or Trinidad asphalt. This insulating material has a comparatively low resistance and would quickly be broken down by a current of very high potential; its resistance is amply sufficient, however, to stand a strain of a few hundred volts, and the material is very durable.

If, from any cause, the insulation is broken down there is no danger to life with the low tension current, but there is very great danger of fire as all the energy in the mains is immediately concentrated on any spot which offers a very low

*Previous "notes" on this subject appeared in ELECTRICITY for Aug. 5 and 12.

resistance. Of course this concentration of energy is guarded against by the insertion, at suitable points in the circuit, of fuses which are melted by any unusual rush of current, thus interrupting the circuit and preventing any further supply of energy for incendiary purposes. That the danger of fire with low tension circuits when the wires are improperly insulated is always present is a fact that we are frequently reminded of.

How much damage can be wrought in this way was pointed out recently by Mr. Edison, who drew special attention to the results of a short-circuit which occurred in some underground mains in New York; not only were the wires melted, but also several feet of the iron tubing in which they were incased, and the paving stones within a radius of three or four feet were reduced to a molten mass. Of course this was an extreme case, and consumers houses are always protected from such alarming phenomena by a proper arrangement of fuses.

In Europe the insulation of underground mains for the distribution of current at a low pressure has been brought down to such a fine point that by several companies insulated cables are no longer used for such work. Bare conductors are employed, sometimes in the form of wires and sometimes in the form of flat strips, or rods of square cross-section. These bare conductors are supported on porcelain insulators placed in iron culverts. This is a very economical method of constructing underground mains for low tension supply, and offers various advantages over cables insulated along their whole length. The wires are perfectly safe in all respects, there can be no sparking because the potential is not high enough; being enclosed in the culvert the wires are not subject to be tampered with in any way, and the size of the conductors can be readily increased at any time when the extension of the service demands additional copper. This last consideration alone is a very important one, as the original investment in copper is thereby reduced, it being unnecessary to place a copper mine underground to start with in order to make sure of being able to meet future requirements. As more customers are obtained and more copper is required to carry the additional current the conductors can be built up by adding extra wires or strips wherever necessary. It is found that the insulation resistance of mains laid on this system is maintained at a perfectly safe figure, and although the idea seems at first sight a bold one, bare underground conductors are used by numbers of electric light companies in London and Paris with the most satisfactory results.

LITERARY NOTES.

At the Street Railway Convention there was distributed an interesting pamphlet entitled "Economy of the Electric Railway" by Mr. J. S. Badger, of the Edison General Electric Company. This little work enters into a consideration of the cost of construction and operation of electric railways and contains a nnmber of concise tables showing the actual results obtained in the operation of seven different electric railways.

In *Harper's Weekly* for October 24, there appears a timely article, "A History of the Street Car and its Development," by Harry P. Mawson, accompanied by a page of illustrations of various types of street car, and sketches of the grips used on cable cars. Curiously enough the electric car is not mentioned in the article and the only substitute that the author finds for horses is the cable.

THE LEONARD SYSTEM OF REGULATING MOTORS.

In a recent issue we spoke of the installation of an electric elevator in Brooklyn, operated under Mr. H. Ward Leonard's new system of motor regulation. Mr. Leonard has just received the following letter, which speaks for itself.

EDISON ELECTRIC ILLUMINATING COMPANY, OF BROOKLYN.

BROOKLYN, Oct. 22, 1891.

MESS. H. WARD LEONARD & Co., Electrical Exchange Bldg., N. Y.

Gentlemen: We have just permanently equipped our passenger elevator with your new system of motor power, and are greatly pleased with the result. The arrangement is perfect in its absolute control of the elevator car, and requires very little attention in its operation.

As the current on the motor is constant, whatever the speed may be, the neutral point is fixed and the brushes require no adjustment to prevent them from sparking.

In this system the motor operates continuously at its highest efficiency and there is no likelihood of the armature burning out, due to sudden changes of load. We are able to instantly reverse the car and motor, at any speed, without any strain whatever, while the motion under all conditions is similar to that of a hydraulic elevator.

Should any one desire to investigate this system they can see it in successful, practical operation at this station. Yours truly,

(Signed) W. S. BARSTOW, Gen'l Supt.

THE CHICAGO SPECIAL TO THE CONVENTION.

Through the courtesy of the Pullman Palace Car Company and the *Street Railway Gazette*, the Pullman palace car "Venice" conveyed to Pittsburgh and back a select company of street railway engineers and technical journalists. The party was organized by Mr. P. G. Monroe, the popular president of the *Street Railway Gazette;* and en route the guests were in charge of Mr. W. S. Louttit, of the Pullman Palace Car Co., who made a perfectly irreproachable travelling host and left nothing undone to secure the comfort of his companions. The "Venice" was side-tracked at the Erie station in Pittsburgh during the Convention, and proved a comfortable hotel for the majority of the party during three days.

The guests on board the "Venice" were: George Standart, of the Exhaust Steam Purifying Co., F. H. Stanwood, of the Stanwood Steel Car-Step Co., W. H. Patton, superintendent of the Patton Motor Co., C. K. Harding, of the Harding Electric Railway Co., W. H. Edgar Jr., of the Dearborn Drug and Chemical Co., N. P. Senat and John Roberts of the *Street Railway Gazette*, E. L. Powers, of *Electrical Industries*, W. Forman Collins, of the *Electrical Engineer*, G. G. McDuff, of the *Street Railway and Electrical News*, and Herbert Laws Webb, editor, and L. W. Collins, of the business staff of ELECTRICITY.

Needless to say that with such hosts as Messrs Monroe and Louttit, good fellowship reigned and a thoroughly pleasant time was passed on both the going and return trips.

NEW YORK ELECTRICAL SOCIETY.

In response to the popular demand for the treatment of electrical subjects in which theory and practice are judiciously combined, the New York Electrical Society has arranged to give, during the season of 1891-2, a series of experimental lectures. The first of these was given on the 22d inst. at Columbia College, by Dr. S. S. Wheeler, on "The Practical Management of Electric Motors."

In opening the lecture Dr. Wheeler dwelt on the importance of attention to many simple details which are too often neglected. He made a special point of care being taken in removing the motor from the packing box. This operation is frequently so roughly carried out that some parts of the motor are damaged, the accurate set of the spindle may be destroyed and other parts so bent as to give subsequent trouble, for which the motor itself instead of its user is blamed.

The common idea is that a motor is a piece of machinery that ought to take up very little room and that can be stowed anywhere. The consequence is that it is likely to be placed on a shelf, or in some out of the way position in which it cannot be properly tended. To give a motor fair play it should be put where it will always be handy for inspection and operation. A great many contingencies are likely to happen; wires may be grounded, and an infinite number of faults may arise to prevent the starting of the motor, and the more accessible it is the sooner will the trouble be remedied.

The selection of the proper kind of motor for the special purpose in view is another point of importance, and dividing motors into two generic classes, constant potential and arc circuit, the lecturer proceeded to show the special characteristics of each, the methods of winding, and their respective suitability for different classes of work. By the help of drawings on the blackboard, and the actual operation of various kinds of motors, the audience was able to gain a practical idea of every point made by Dr. Wheeler.

The subject of regulation was similarly treated and illustrated. An especially interesting part of the lecture was that in which different devices that had from time to time been adopted to secure the increased efficiency of various parts of the machine were shown. The extent to which these devices had failed or succeeded in carrying out the intention of their inventors was explained, and the various steps of the evolution of the admirable motor of to-day were lucidly and entertainingly described.

The lecture was concluded by a brief summary of the commonest causes of motor troubles, and a recital of the promptest and simplest remedies to be adopted in each particular case. Dr. Wheeler then invited the audience to make a close inspection of the various apparatus which he had collected for the purpose of illustration, which were put into operation.

STANDARDS IN STREET RAILWAY PRACTICE.*

BY OSCAR T. CROSBY.

The object of the paper was to present some suggestions concerning a standard rating for electrical machinery, standard dimensions for parts of car apparatus, standard nomenclature for methods and parts, and standard method of keeping accounts.

It is common to speak of a machine as a fifteen h. p. or a twenty-five h. p. motor, with scarcely any further suggestion of conditions under which it is supposed to operate. A motor may perform under certain conditions double the work at which it is rated. Should we use the maximum rating, we have the advantage of knowing at once very nearly what is the limit of service which the motor can perform; but, on the other hand, we fail to be told by such rating what the capacity of the machine is when doing the average work of our service.

There is at present no conventional uniformity controlling either the manufacturer or purchaser of electrical machinery in regard to these matters, which can be determined only by the custom of the trade, as it may grow up through years of uncertainty or as it may be directed to more rapid maturity by the action of such an association as this. We shall not, of course, be able at once, by any such formal action as we might take, to bring everybody concerned to an immediate acceptance of such standards as we might adopt. Yet, we will certainly go far towards hastening the time when some really definite and valuable information will be given to the purchaser when he is told that a motor is rated thus or so.

It would, of course, in any such rating, be assumed that the machine is working under a pressure of 450 volts, which is not far from that found on most of the lines throughout this country. In the necessary regulation to which these motors are subjected, a part of this pressure is practically applied to some resistance, external or internal, with respect to the motor; but I can see no convenient way of taking this into account in determining upon a rating. Indeed, the action of a series motor in street railway service is very complex, and it is much more difficult than sometimes supposed to determine upon a rating which shall give the greatest amount of valuable information. The very difficulty, however, is warrant for approaching the subject seriously and industriously.

I think it useless to attempt any change in the rating of dynamos. Their work is so much more regular than the work of a motor that the present rating in horse-power or watts seems to answer the purpose fairly well. Nor has it occurred to me as advisable to extend this rating of watts to motors, as it will be a matter of difficulty to introduce a comparatively unfamiliar term and apply it to a machine whose capacity must constantly

*Abstract of a paper read at the American Street Railway Association Convention Oct. 23, 1891.

be talked about, and which, as above stated, works under very complex conditions.

Second: I feel that the time has now come when some of the physical dimensions of electric cars may, with benefit to all, be standardized. As to how far such standardization should go, committees of this association can best determine. The guiding principle, it seems to me, should be this: That standardization of parts should be so directed as not to interfere with the progress of invention. Bearing this in mind, may we not at this stage of development have a standard axle diameter for cars of a given weight? Also standard key weights for gears? And while there is some uncertainty in my mind on this point, may we not have a standard gearing? It of course involves uniformity in the reduction ratio between speed of the armature and speed of the car. There is, however, no very great difference now in this respect, and the possibility of uniformity is at least worth considering.

Coming to trolley apparatus, we might have uniform poles, pole sockets, and uniform diameter of pole at the butt; also uniform length of pole and uniform diameter of trolley wheel.

It may be possible to go further into this standardization of dimensions of parts of the truck which are not directly connected with the electric apparatus. I think it best, however, to leave that to those more familiar with truck manufacture.

It will be seen that the suggested number of standard dimensions in electrical apparatus which thus far seems possible, is not large. Yet certainly uniformity of axle diameter and key weights alone would be found of much value to all interested in the business, Should this Association adopt such standards, it is of course understood that any manufacturer who thinks he has good reason to vary from them will do so, presenting to the trade his justification for such action. It seems, however, beyond question that a number of these points, in which there is no mystery whatever, may just as well be determined by the direct users of apparatus as by the designers, and may thus be determined once for all.

Third. In regard to standardizing nomenclatures, the object is to save what may be called "lost motion" in the verbal and written correspondence incident to our business. The importance of some such effort was emphasized to me some time ago when, on reading a carefully drawn set of instructions to linemen prepared by an engineer of the Thomson-Houston Electric Company, I could see that those instructions would scarcely be intelligible to a man whose experience had been confined to the material of another company, say that of the Edison company, although the things talked about might be entirely familiar to him. Besides causing annoying repetition and much explanation between men really understanding very well the thing in question, this uncertainty of nomenclature may at times stand seriously in the way of the proper interpretation of written contracts, or of orders received by dealers. As a basis upon which some further and better work in this direction should be done, I give herewith a table showing list of proposed terms, with various terms heretofore used as equivalents, and definitions properly limiting the proposed terms. In some cases when there has been satisfactory uniformity, no equivalents are given, but definitions are suggested. The list can, with benefit, be considerably extended.

NOMENCLATURE OF ELECTRIC RAILWAY TERMS.

Generator.—(Generator, dynamo.) Machine in which the electric current is generated.

Motor—(Motor.) Machine in which the electric current is transformed into mechanical power.

Frame.—(Frame.) Iron body of machine, including pole pieces and standards or side arms, if any, but not including base plates and bearings.

Standards.—(Standard bracket.) Supports of the bearings of generators.

Side Arms.—(Side arms, check pieces, armature bracket.) Supports of bearings of railway motors.

Pole Pieces.—(Pole pieces.) That part of frame from whose surface lines of force may pass directly to the armature.

Field Coil,—(Field coil, spool.) Coils of wire wound on frame in such a way that a current passing through these coils makes magnets of the frame and pole pieces.

Brush Holder.—Device for holding the brushes in contact with the commutator, including the insulation used in its support.

Rocker Arm.—(Yoke, rocker arm.) Device for holding brush holders in position on commutator while attaching it directly or indirectly to the frame.

Fuse.—(Fuse, fusible plug.) A metal device for opening circuit when the current becomes abnormally large, the soft metal being melted by a current of fixed quantity.

Switch.—A device for closing or opening a circuit at one or more points.

Rheostat.—(Resistance box, rheostat.) Wire or other material suitably protected and conveniently arranged to be introduced in more or less proportion into a circuit.

Trolley.—(Trolley contact bar.) A device used to transmit the electric current from the overhead wire to the cars, consisting usually of a

Trolley Wheel.—A small metal wheel making rolling contact with the overhead wire.

Trolley Fork.—Mechanically connecting trolley wheel to

Trolley Pole.—Supporting the trolley fork and wheel and resting in a socket, which is part of the

Trolley Base Frame.

Trolley Wire.—Wire from which the trolley wheel directly receives current.

Trolley Frog.—(Frog, overhead switch, trolley switch.) A device used to fasten or hold together the trolley wires at a point where the trolley wire branches, and to guide, ordinarily, automatically the trolley wheel along the wire over the track taken by the car.

Trolley Frog.—(Standard frog.) A frog designed for use at a point where two branch lines make equal convergent angles with the main line.

Right Hand Trolley Frog.—A trolley frog designed for use at a point where a branch trolley wire leaves the main line to the right in the going direction.

Three Way Trolley Frog.—A trolley frog for use at a point where the line branches in three directions.

Draw Bridge Cross-Over.—A device permitting the easy passage of a trolley wheel from one to the other of two adjacent wires in a continuous direction.

Trolley Crossing.—(Crossing frog, cross-over.) A device placed at the crossing of two trolley wires by which the trolley wheel running on one wire may cross the other, the device also holding the two trolley wires together.

Insulated Trolley Crossing.—A device placed at the crossing of two trolley wires, by which the two wires are insulated from each other and by which the trolley wheel running on one line may cross the other.

Straight Line Hanger.—The hanger used on a straight line and supported from a span wire, the strain on same being essentially vertical.

Single Curve Hanger.—The hanger supported by a lateral strain in one direction and, ordinarily, on single track curves, except at ends and the inside curve of double track.

Double Curve Hanger.—The hanger supported by lateral strain in opposite directions, used ordinarily at ends of both single and double curves and at intermediate points, and on double track curves.

Feeder Clamp.—Clamp with a device by which a feed wire may be connected to the trolley wire.

Feeder.—A wire usually insulated, used for transmitting current from the power station to the mains or the trolley wire direct.

Mains.—Wires usually insulated, serving for the distributing of current from the feeders to the trolley wire through tap wires.

Tap Wires.—Wires to convey current from feeders or mains at the pole to a near point of the trolley wire.

Trolley Section.—A length of one trolley wire with or without branches but continuous electrically.

Line Section.—A part of the overhead conducting system so insulated from other parts as to permit the supply of power to be separately controlled.

Section Box.—A box containing section switches and fuses used for control of a trolley section or line section.

Mr. Crosby concluded his paper by laying special stress on the importance of adopting a standard method of keeping accounts and communicated a studious paper on this subject, accompanied by numerous blanks and forms, prepared by Mr. W. E. Baker, of the Thomson-Houston Electric Company, who has for a long time been in charge of the work of maintaining the motors and lines of the West End Street Railway Company.

THE TECHNICAL PRESS AT THE CONVENTION.

The street railway and electrical journals had a strong force of representatives at the Pittsburgh convention, and electrical literature of all sorts abounded on all sides. The *Street Railway Journal* entertained its friends in two large parlors, and with commendable enterprise printed each day a special edition, giving a full report of the proceedings; almost the entire staff of the *Journal* was present, headed by J. H. McGraw, president, and the blithe and genial vice-president, C. E. Stump. The *Electrical Engineer* was represented by its well known editor, T. C. Martin, and W. Forman Collins, the Chicago manager. The *Electrical World* had on hand W. J. Johnston, Dr. Louis Bell and L. H. Hart. The *Electrical Review* was represented by C. W. Price, editor, and S. L. Coles. The *Electrical Age* printed a daily bulletin and had T. R. Taltavall, W. T. Hunt and E. V. Cavell to look after it. The *Street Railway Gazette* had headquarters at parlor 7, where P. G. Monroe presided, assisted by N. P. Senat and John Roberts. ELECTRICITY shared the headquarters of the *Gazette*, and decorated the room with a collection of ELECTRICITY illustrations which attracted much attention. The *Street Railway Review* was represented by H. H. Windsor, *Electrical Industries* by E. L. Powers, the *Street Railway and Electrical News* by G. G. McDuff, and the *Tramway and Railway World* by F. X. Cicott.

In the type-setting machine contest now in progress in Chicago many favorable comments have been made by visitors from all parts of the country. A number of visitors present are practical printers and foremen of press-rooms. They have nearly all expressed a favorable opinion of the electric motor for running presses. Some of them have been heard to deplore the fact that they are unable to obtain current on account of their location with respect to the central stations. It is a well recognized fact that an electric motor is the most economical power generator for printing presses, type-setting machines and other machines requiring power only at stated intervals. The fact that a motor takes up only a small space and is practically noiseless plays a very important part in its selection for such work.

FROM NEWS CENTRES.

NEW YORK.

NEW YORK, Oct. 24th. The final report of the Rapid Transit Commission has been given to the public. The road is to have four underground tracks on the same level and will be reached by stairways from the street. The average width of the tunnel will be 44 feet, and the height 11 feet 6 inches. The roof of the tunnel will be nine feet below the surface of the street, and the report states that there will be no necessity to disturb the surface of the street, except for stations and air shafts. The motive power is to be electricity, or some other power not requiring combustion within the tunnel; and the motors drawing the cars are to be capable of a uniform speed for long distances of not less than forty miles an hour, exclusive of stops.

The Commissioners, while assuming that electricity will be the motive power say they do not deem it advisable to exclude other forms of power answering the essential conditions of speed and non-combustion in the tunnel, or to attempt to direct the exact method of application of such power as shall finally be adopted. Although it is the opinion of many that the simpler, cheaper and more rapidly constructed deep tunnel would constitute a perfect and permanent method of rapid transit, there is no doubt that the plan proposed will meet the needs of the city for many years to come. The question of collision with property rights, however, may prove a very serious one, and it remains to be seen whether the capital can be raised to carry out the scheme. On this subject the opinions, drawn from various authoritative sources, that have been published in the daily papers, are about as divergent as it is possible for them to be.

Mr. Wanamaker has been considering several innovations for the improvement of the postal service, among which are the pneumatic tube system, an electrical system and a scheme for having mechanical boxes attached to every house. It is proposed to lighten the labor of the letter carrier fifty per cent. by the adoption of the last named system, but whether the householders will care to pay $1.10 for the privilege of having a box, as well as the cost of keeping it in order, is a matter which has not yet been satisfactorily determined.

The Long Island City Board of Aldermen have granted to the New York and Long Island Railroad Tunnel Company the privilege of extending the outlet of the tunnel under the East River across certain streets in Hunter's Point. The tunnel will pass under the proposed rapid transit tunnel and will have two routes on the Long Island side of the river.

The patent litigation between the Electrical Accumulator Company and the Julien Electric Company is to be reopened. The Accumulator Company, by a decision of Judge Coxe, of the United States Court, was given a perpetual injunction against the Julien Company, but now the latter claim to have discovered that the patent upon which the plaintiffs base their claim expired in Europe last summer, and that its expiration there necessarily involves expiration in this country. Judge Coxe has decided to reopen the case to allow them to make good this claim.

G. H. G.

MONTREAL.

MONTREAL, Oct. 21.—What Montreal needs most is some efficient system of rapid transit. Plans have been formed for constructing an electric road, and Mr. R. A. Mainwaring, who is at the head of the movement, is pushing the matter vigorously. There is reason to believe that he will eventually succeed, notwithstanding the scant sympathy of the city fathers. One serious difficulty, however, has to be considered in regard to the running of electric cars in Montreal, and that is the amount of snow in winter. The horse car lines substitute sleighs for cars during the winter months. The difficulty may be avoided by constructing an elevated road. The aldermen have had submitted to them a description of the Davis Electrical Cable Elevated Railway, which could be constructed for $25,000 per mile. The outcome of this scheme is doubtful, but certainly some method of electric traction will be adopted, and whatever the difficulties, Mr. Mainwaring seem fully competent to deal with them.

Canadians feel justly proud of their fine telephone and telegraph communications. The admirable telephone service enjoyed by Montreal and Toronto may be largely attributed to the fact that no one company has the monopoly of manufacturing telephones. The credit for this is greatly due to Mr. W. C. Hibbard, late of the

Hibbard Electrical Manufacturing Co., of Montreal. The Bell Telephone Co. originally obtained in Canada the patents which they had previously secured in the United States; but instead of manufacturing their instruments in the country within one year, as the law demands, they brought the various parts from the States and put them together here. Mr. Hibbard grasped the situation and began to make telephones. Although the Bell Telephone Co. brought suit against him, they were defeated and the patent became invalid. Now anybody may manufacture telephones in Canada.

Since the consolidation of the Bell and Federal companies, there has been but one telephone company in Montreal—the Bell—which has over 7,000 subscribers. This company operates five exchanges: the Central, with a capacity of 3,000 subscribers; the Central Annex, 1,000 subscribers; the West and East ends, each with 2,000; and the South-West end with 1,600 subscribers. This system affords ample communication throughout the city and surrounding suburbs. The rate per annum since the consolidation is $50, while before it was $25. Much dissatisfaction has been caused by the increased price, and so many household patrons threatened to have the instruments removed that the company was obliged to lower the rate for private houses to $30, still retaining it at $50 for stores or offices. Considering the service which a telephone renders in a store or office, the price—a little less than one dollar per week—is small enough. H. T. B.

BOSTON.

Boston, Oct. 24.—The city of Malden will soon be connected with Boston by an electric railway. The West End Railway Co. is rapidly extending its electrical system in that direction.

There will soon be seen on the streets of this city a duplicate of the Pullman centre-vestibule top seat car recently illustrated in Electricity. It has been ordered by the West End Railway Co., to ascertain how the citizens of Boston and district like its appearance and comforts.

The Selectmen of Weymouth and Hingham have granted the promoters of the Weymouth and Hingham Electric Street Railway Co. permission to construct their tracks on Sea and Bridge streets, and it is expected that the work of construction will begin shortly.

There is every prospect of a company with a capital of $100,000 being organized in Taunton, Mass., to erect a factory for the manufacture of a newly patented street railway car. Already a large amount of stock has been subscribed for in Taunton itself.

A petition is about to be presented to the directors of the Worcester and Spencer Electric Railway Co., by the citizens of Brookfield, to extend its system to Warren. Should the movement fail, it is expected that a new company will be organized for carrying out the work.

The project of establishing a large electric light and power station at Mitchell's Falls, near Haverhill, Mass., is being quite warmly discussed.

The streets of Providence, R. I., are in a somewhat demoralized condition at present, owing to the laying of the electric railway track. The citizens, however, appreciating the boon of traveling by electric cars, bear the temporary discomfort with equanimity.

The Porter-Leavitts Co., whose diminutive but highly efficient motors are being freely adopted, is about to erect a factory near their present one, on Laura street, Providence.

The Erie Telephone sub-companies made a net gain of 194 subscribers for the quarter ending September 30, and now have 13,733 subscribers.

The East Middlesex Horse Railroad Co. will be given a hearing next Monday evening, by the Malden City board of aldermen on a petition for authority to equip its system electrically.

The Boston Electric Light Co. now owns the central station of the New England Weston Illuminating Co., situated near the Providence depot in this city. W. S. K.

PERSONAL NOTES.

Not many gentlemen in the electrical field enjoy a wider or pleasanter acquaintance than Mr. W. A. Hathaway, of the American Electrical Works, Providence, R. I. As first lieutenant to Mr. Eugene F. Phillips at his annual and popular clam bakes, Mr. Hathaway has for many years past been brought into close personal contact with the electrical fraternity and he has spared no efforts to make those gatherings pleasant for every guest. His many friends now extend their sincerest wishes for many years of happiness with his charming bride, formerly Miss Louise H. Johnson, to whom Mr. Hathaway was married in Providence on Thursday, Oct. 15.

Mr. G. W. Adams is now snugly ensconced in his new quarters at 111 Arch St., Boston, where, with his comprehensive electrical and patrol equipment, he is able to extend his efficient burglar alarm service, which for many years has cared for the bulk of the commercial buildings of Boston. Mr. Adams has recently established his electric protective system in New York and is already doing a large business.

Mr. Henry C. Spaulding, the originator of the underground system of railways proposed as an effective solution of the rapid transit problem, has just published a pamphlet on "Local Transportation at Boston." The work, which is profusely illustrated with plans, drawings and perspective views of the projected undertaking, is engaging a large share of public attention, some of the local papers declaring that Mr. Spaulding's plan, if carried out, will solve the problem for all time.

Mr. E. I. Garfield, secretary of the Thomson-Houston Electric Co., is making an extended trip through the west, and will be absent several weeks.

Mr. F. S. Pearson, chief electrical engineer to the West End R. R. Co., has written a strong endorsement of the new Thomson-Houston S. R. G. motor, which has been tried on a Robinson Radial car having a load of 15,000 pounds aboard, with which it easily ran up a 6¼ per cent. grade.

Mr. A. A. Brown, of Denver, Col., agent for the Thomson-Houston Electric Co. in that city, is in Boston this week. Notwithstanding the depression of trade in Denver the electrical business is good and increasing rapidly.

Mr. W. J. Hammer, of New York, was in Chicago this week visiting friends. While here he took a look over the World's Fair grounds.

COMMERCIAL PARAGRAPHS.

The regular dividend of two per cent., amounting to $7,500 was paid Oct. 10, on the $375,000 of preferred stock of the Great Western Electric Supply Company. A dividend is also to be paid on the common stock of the company, if the business continues to prosper for the next two or three months as it has for the past three.

Mr. Geo. H. Meeker, manager of the New York Insulated Wire Company, Nos. 78, 80 and 82 Franklin street, Chicago, has received the first of a shipment of three car-loads of Grimshaw white core wire and B. D. Wires from the factory at Wallingford, Conn. In this shipment there is one million feet of their celebrated trade Nos. 228 and 227, No. 14 B. & S. wire, or more than enough to reach from Chicago to Davenport, and the total shipment, if strung on poles, would nearly reach across the United States. The success that this company has had in the sales of their goods since opening their Chicago store has amply warranted such large shipments. Their "Vulca" electrical wire ducts are about to be installed in the new Masonic Hall at Utica, N. Y., and are being extensively used throughout the west.

The Chicago Electrical Manufacturing Company is constructing a new style hot-wire voltmeter and ammeter that is soon to be placed on the market by a prominent electrical supply house. The company has received an order to build seventy voltmeters and over one hundred ammeters.

Mr. Geo. Cutter, of Chicago, filled an order for over twelve miles of Simplex Wire last week. From the orders that are coming in, Mr. Cutter thinks that this brand of wire is likely to be used extensively.

THE EXHIBITS AT THE STREET RAILWAY CONVENTION.

A tour of inspection through the parlors of the Monongahela House, at Pittsburgh, during the three days of the Convention last week would have been a surprising experience for any one not thoroughly imbued with the idea that electric traction for street railway work is *the* power of the day. In any case such a ramble would have been a liberal education in the science of short distance travel and the appliances necessary of the proper equipment of complete electric railway systems. It is astonishing how quickly electricity has taken the foremost position in this field. A few years ago electrical men scarcely gave the Street Railway Convention a thought. Now it is almost purely an electrical convention; most of the visitors are electrical men and most of the exhibits are made up wholly or partly of electrical appliances, as the following notes on the exhibition will show.

The Edison General Electric Company had a very novel exhibit in a large parlor on the ground floor. In the centre of the room was a Brill street-car truck equipped with two Edison single-reduction motors, which were shown in operation, current being taken from the lighting circuit of the house. Quite a small library of electric railway literature was distributed by the representatives in charge of the exhibit, Messrs. M. J. Sullivan and J. H. Silverman. Among the other representatives of the Edison Company present at the convention were Messrs. S. Dana Greene, J. Kelly, Fuller and Andrews.

The Westinghouse Electric Company evidently considered themselves in honor bound to act as hosts to the whole convention. Parties of delegates were taken in carriages to the factory, where they were courteously received by Mr. Bannister, the Vice-President of the company, and shown a magnificent display of Westinghouse appliances, besides being taken on a tour of inspection round the factory. Westinghouse Gearless Motors were in operation on the street-cars in Pittsburgh, and beautiful models were shown at their headquarters in the hotel, where a large supply of Westinghouse literature was on hand. A very pretty souvenir was presented to some of the visitors, it being an aluminum paper weight in the shape of a Westinghouse iron-clad gearless motor. The Westinghouse representatives at the convention were Messrs. H. McL. Harding, F. P. Barnes, C. B. Osgood, R. S. Brown, J. M. Atkinson, J. L. Barclay, B. F. Stewart and H. W. Grannis.

At the headquarters of the Short Electric Railway Co. the new car rheostat of the Short system was shown. Some very handsome souvenir literature was given to visitors to instruct them in the merits of the Short system. The company was represented by Sydney H. Short, president, J. Potter, vice-pres., E. E. Higgins, gen'l mgr., J. H. Gibson, supt. of construction, and the following other officers and district agents: Messrs. M. K. Bowen, C. C. Curtiss, G. P. Rowe, F. A. Rogers, W. Hazelton 3rd, J. C. Dolph and J. E. Ridall. Short motors were in regular service on some of the Pittsburgh lines, and were shown in operation on the exhibition barge.

The Thomson-Houston Electric Company had on exhibition many of their electric railway specialties, and gave visitors the opportunity of making useful additions to their libraries in the shape of a number of interesting little pamphlets treating of electric railway topics. The T.-H. representatives were: Capt. Eugene Griffin, O. T. Crosby, W. H. Knight, T. B. Bailey, F. H. Clark, W. J. Clark, Geo. W. Mansfield and Alec. H. Lewis.

The Electric Merchandise Co., of Chicago, had a busy time of it at their headquarters, a constant stream of visitors pouring in to inspect the Burton Electric Heater. Dr. Leigh W. Burton, the inventor, was present to explain the construction and operation of this interesting device, which of its own accord lent considerable heat to all arguments in its favor. The Electric Merchandise Co. also showed a complete line of electric railway supplies, among which they drew special attention to raw-hide pinions for motor gearing, and to the "New Departure" street-car alarm bell. The company was represented by W. R. Mason, general manager; A. H. Englund, secretary and treasurer; W. L. Adams, F. X. Cicott and D. B. Dean.

Alexander Barney and Chapin, the well known supply house of New York, had a brilliant exhibit of general electrical supplies in charge of Charles E. Chapin, vice-president. The special feature of the exhibit was the new A. B. C. railway lamp, the filament of which is held taut to the top of the bulb by a little carbon loop; this prevents vibration and unnecessary wear of the filament.

The J. G. Brill Company, of Philadelphia, had a handsome exhibit of models of standard Brill car trucks at their headquarters. Besides this they had a No. 13 truck in the Edison exhibit already described; running on the Smithfield street line they had an 18-foot car with a No. 13 truck equipped with Short gearless motors, also on the same line a similar car equipped with a Westinghouse gearless motor. On the Duquesne Traction Company's line a Brill car was in service equipped with Thomson-Houston motors. In the street opposite the hotel was a 25-foot "Maximum Traction" Brill car, made for a Cleveland railway. No one can question that the Brill Company had a comprehensive and moving exhibit. The company was represented by J. A. Brill, vice-president; J. A. Hanna, P. K. Andrews and Edward Cline.

The Calorific Ventilating Heater Company, of Chicago, exhibited their well-known heater for street cars. This company attracted a good deal of attention by their novel and ingenious advertising devices and souvenirs. Their representatives were Messrs. L. E. and Garson Myers, who made many friends for the company by the genial manner in which they received visitors. The warmth of the heater was evidently contagious.

The Gould and Watson Company, of Boston, Chicago and London, dealers in mica, for electrical purposes, had an interesting exhibit of moulded mica insulators of all varieties and for all purposes. The company was represented by C. T. Lee and E. P. Sharp, of Boston, and R. B. Pierpont, of Chicago. This company has lately acquired the business of the Whitney Electrical Instrument Company, and exhibited some very compact voltmeters and ammeters, which are of moderate cost but guaranteed to give accurate readings.

The St. Louis Car Company, exhibited a model of their centre-vestibule street car, which can either be built new or by splicing together two ordinary cars. The company was represented by P. M. Kling, vice-president.

Post & Co., of Cincinnati, manufacturers of railway supplies and patented specialties, had a well arranged exhibit of general railway supplies, electrical appliances predominating. The company was represented by Isaac Kinsey, president.

The Benedict and Burnham Manufacturing Company, of New York, makers of insulated and bare wire and cables, exhibited coils and drums of hard drawn copper trolley wire and samples of their magnet wires. The company was represented by E. H. Oswald.

The New Process Raw Hide Company, of Syracuse, exhibited specimens of their raw hide pinions for railway motor gearing. T. W. Meachem, president, and A. C. Vosburgh, secretary, were the representatives in charge.

The New York Car Wheel Works, of Buffalo, manufacturers of "Machined" car wheels, had a very imposing exhibit of their wheels which attracted general interest. The representatives in charge were J. R. Elliott, B. G. Hann, Jr., E. Packer and R. J. Mercier.

The Griffin Wheel and Foundry Company, of Chicago, exhibited their wheels, the special feature which excited most attention being their "Curved Arm Motor Wheels." This style of construction was very generally praised. The company was represented by A. G. Wellington, F. L. Whitcomb and W. F. Newbert.

The Hill Clutch Works, of Cleveland, makers of friction clutch pulleys and cut-off couplings, ball and socket self-oiling bearings, and other patented specialties, were represented by S. S. Leonard.

The Lewis & Fowler Mfg. Co., of Brooklyn, exhibited their well known girder rails, which made quite a substantial display.

Badger Brothers, machinists, of West Quincy, Mass., exhibited their patent self-oiling trolley wheel. This wheel is made of composition metal and it is perfectly smooth running owing to the action of the self-oiling device. The head of the firm of Badger Brothers was in attendance at the convention.

The Munson Belting Company, of Chicago, had a good display of belting of all sizes and classes. The company was represented by J. H. Shay.

The Revere Rubber Company of Boston, showed a very complete exhibit of hard rubber goods. This company makes a specialty of a very tough hard rubber compound for insulators and insulating fittings; their trolley insulators will stand any amount of rough treatment. Another special feature which was on exhibition is "Flexite," a new flexible hard rubber tubing for electric wiring. C. B. Elliott, manager of the company, was in charge of the exhibit.

The Standard Paint Company, of New York, manufacturers of "P. and B." insulating paints and compounds, were represented at the convention by Frank S. DeRonde, the manager of the company.

The Dearborn Drug and Chemical Company, of Chicago, manufacturers of drugs, chemicals, boiler solvents, etc., were represented at the convention by Wm. H. Edgar, manager. Mr. Edgar issued a handsomely printed invitation requesting delegates to the convention to send to the laboratories of the Dearborn Company a sample of the water used in their steam boilers, stating that an analysis would be made and a copy of the report forwarded free of charge. No doubt many will avail themselves of this liberal offer.

The Mitchell Brant Copper Company, of Erie, Pa., manufacturers of commutator segments and copper castings of all kinds, had an exhibit of their products in one of the parlors on the main floor. Mr. A. L. Daniels was the representative in charge.

Charles A. Schieren & Co., manufacturers of the famous oak leather belting, were represented by E. P. Atkinson, who found his company's goods so well known that he was not required to explain to many the good points in their favor.

The Ball & Wood Company, of Elizabeth, N. J., and New York, builders of the well-known Ball Automatic Cut-off engines, were represented by F. H. Hayward.

The Exhaust Steam Purifying Company, of Chicago and New York, manufacturers of Sinclair Stuart's Patent Oil, Grease and Dirty Water Extractor, were represented by Geo. Standart, secretary and treasurer of the company.

The United States Mineral Wool Company, of 2 Cortlandt street, New York City, exhibited, among other specialties, their patent "Corrugated Copper Gasket," for preventing leaky joints in machinery using steam, water, air, acids, etc.

Mr. C. S. Van Nuis, the well known electrical engineer and inventor, was showing to interested groups his new "Fulmen Arrester" for protecting street railway circuits from damage by lightning.

The Meaker Mfg. Co. had an able representative on hand in Mr. J. W. Meaker to interest visitors in the merits of their new styles of combination fare registers.

W. H. Weston & Co., of Philadelphia, had a fine display of switches in charge of Albert E. Plowman.

The Standard Underground Cable Co., of Pittsburgh, New York, Chicago and numerous other places, were, of course, out in force. A good display of cables of this company's manufacture occupied a prominent position, and the very genial agents of the company, Geo. Wiley and F. E. Degenhardt, were here, there and everywhere, always surrounded by friends.

The National Underground Conduit Co., of New York, was represented by J. P. McQuaid.

The Bridgeport Brass Co. made an excellent display of their trolley and feeder wires.

The Interior Conduit and Insulation Co., of New York, exhibited a section of their well-known insulating conduit which has been used with such marked success in the construction of underground feeders for electric railways. The company was ably represented by the genial and popular president, Mr. E. H. Johnson.

The Pittsburgh Steel Hollow Ware Co. had a very effective and original exhibit of their rolled steel gongs. The gongs were arranged as chimes and every now and then gave out sweet music which naturally attracted very general attention. A novel idea at an exhibition is always worth a good deal and this was certainly one. The gongs are indestructible, beautifully finished and have a very sweet tone. The company was represented by its popular secretary and treasurer, Mr. W. S. Griffiths.

The Johnston Mfg. Co. exhibited the Johnston Patent Safe Automatic Disconnector, an appliance for automatically cutting off the current from a section of the trolley wire the moment a break occurs, thus rendering the broken wire perfectly safe to handle and abolishing the danger of grounds or short circuits. Mr. Johnston, the inventor, and F. B. Jacobs, secretary of the company, were kept busy all the time explaining the action of this device to enquiring crowds.

The Detroit Electrical Works, with their usual enterprise, had car No. 17, on the road of the Duquesne Traction Co., completely equipped by the Rae system. The car was in operation during the convention and every delegate received a neatly engraved pass for a trip on it. The Detroit Electrical Works were represented by Mr Frank B. Rae, the inventor, by Mr. Charles A. Benton, the talented engineer and manager of their street railway department, and by Mr. E. E. Slaght, of the Reliance Electrical Manufacturing Co., of Waterford and Toronto, the Canadian representative of the Detroit Electrical Works.

The American Electrical Works, of Providence, R. I., and Montreal, manufacturers of cables and insulated wires of all classes, were represented by P. C. Ackerman, their genial New York agent, who distributed a number of unique souvenirs to remind their many friends of the excellence of this company's wares.

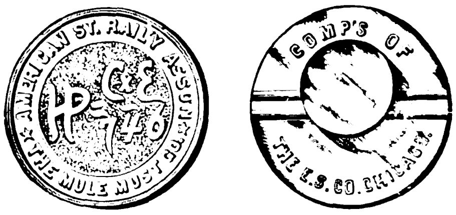
The Gennett Air Brake, manufactured by the Gennett Air Brake Co. of Chicago, was shown in operation on car No. 1 of the Pittsburgh and Birmingham Electric Railway. The Gennett Co. had headquarters at the Duquesne Hotel.

The R. D. Nuttall Co., of Allegheny, had headquarters at the Monongahela House and issued a general invitation to the delegates to visit their factory across the river. This company makes a specialty of their "Improved" rawhide pinions and they manufacture a full line of street railway supplies and repair parts for all electric railway systems. Their special representative at the convention was Mr. C. J. Mayer.

The Stanwood Steel Car Step Co., of Chicago, made an interesting exhibit of their patent steel car steps. The company was represented by F. H. Stanwood, the inventor of the machinery for manufacturing this novel style of car step.

The Carpenter Electric Heating Manufacturing Co., of St. Paul, Minn., manufacturers of electrically heated tools and special devices, exhibited their new electric car heater. The heater attracted attention on account of its lightness and compactness. The company was represented by Mr. Carpenter, the inventor of the heater.

The Electrical Supply Company, of Chicago, had a very interesting exhibit of electrical railway material in Parlor 37 and in the hall leading to the Convention headquarters. Among the features of this exhibit which excited general interest, were the Wood Trolley Catcher, the Wood Car Connector, Wirt voltmeters and ammeters, E. S. standard trolley wire hangers and insulators, Reed oil feed for trolley wheels, Shield brand and Habirshaw underground and feeder wires. The E. S. Co.'s souvenir badge was in great



THE E. S. CO.'S SOUVENIR BADGE.

demand and the supply was quickly exhausted. The company intends to have some more struck off for about 300 delegates who arrived too late to secure them at the convention. The Electrical Supply Co., whose parlor was one of the best decorated and most freely visited, also exhibited John R. Fletcher's Dayton Arc Light Cut-out. The able representatives in charge of the exhibit were Messrs. Wm. Taylor, assist. mgr., and M. M. Wood.

Wallace and Brown had an extensive exhibit of general street railway supplies, in charge of M. W. Brown, pres., and J. E. Wallace. A special feature of this display was the Cook Car Replacer, for re-tracking derailed street cars.

The Peckham Mfg. Co. showed one of their Cantilever street car trucks. E. Peckham and E. E. Stark were in attendance to explain its merits.

The Morton Steam Heating Co., of New York, had an exhibit of their specialties in charge of Eugene Carrington.

Wm. Gardam & Son, of 98 John St., N. Y., machinists and experts in the manufacture of mechanical and electrical apparatus to inventors' designs, had a pretty exhibit of models and were represented by Joseph Gardam, a partner of the firm.

John White, of Allegheny, manufacturer of the "J. S. & W." electric railway insulators, had an exhibit of his various styles of insulators, and was represented by W. S. Jarboe and W. P. Seibert. These insulators are made with a frame of malleable iron and brass, the insulating material being hard wood specially treated.

The Schneider Combination Car Co. exhibited models of their ingenious combination cars, which can be quickly converted into open or closed, the same cars being available for both summer and winter use. By this company's system old box or open cars can be rebuilt to a combination car. The Schneider Co. was represented by John C. Schneider, superintendent and vice pres ident, and Bernard McDevitt, manager.

The Pittsburgh Trolley Co., of Pittsburgh, exhibited Duncan's Patent Improved Trolley Stand and Wheel. The trolley wheel is self-oiling and runs for two weeks without attention.

The Universal Electric Railway Construction Co., of Philadelphia, exhibited two of their special appliances, the Universal Clutch and the Universal Armature. The clutch, which can be applied to any armature, permits the armature to continue revolving after the car has stopped, and in starting throws the load on the armature so gradually that sudden strains are entirely avoided. The "Universal" armature has many good points, among others lightness and efficient ventilation, and is designed to take the place of any armature now in service. The Universal Co. was represented by A. G. Leech.

The Western Electric Co., who make everything electrical and have factories all over America and Europe, had a good exhibit of general supplies and gave away the neat little pocket edition of their new catalogue. Their representatives were E. W. Bennett and M. B. Austin, of Chicago, and S. L. Chase, of New York.

J. B. Wallace and Sons, of Ansonia, Conn., and New York, had a fine exhibit of wires and general supplies. Mr. Goldmark was the special representative on hand.

Pullman's Palace Car Co. had headquarters at Parlor 7 of the Monongahela House. Messrs. A. B. and C. P. Pullman and J. S. Louttit, private secretary, were present at the convention.

INCORPORATIONS.

Edison Electric Light and Power Company, of Jersey City, Jersey City, N. J.; capital stock, $500,000; promoters, R. M. Jarvis, C. B. Van Dyke, D. E. Cleary, P. G. Van Zandt, B. A. Watson, Jas. Warner, J. D. Carscallen, F. J. Matthews, H. Lembeck, A. Q. Garretson, Wm. F. Abbett, all of Jersey City, N. J.

Egyptian Pottery Company, Trenton, N. J.; capital stock, $14,000; manufacture from the raw material sanitary ware and electric supplies of all kinds, and to sell the same; promoters, Chas. H. Baker, C. Turford, Jno. Brindley and M. J. Carroll, all of Trenton, N. J.

The American Manufacturing and Engineering Company, Elizabeth, N. J.; capital stock, $100,000; manufacturing, operating and selling electrical and mechanical apparatus; promoters, Sam'l. T. Hillman, New York City, N.Y.; Asa D. Phillips, Plainfield, N. J.; Chas. W. Leveridge, Brooklyn, N. Y.

Cornwall Electric Lighting and Power Company, Cornwall, N. Y.; capital stock, $15,000; promoters, Thos. Taft, S. B. Young, Henry W. Chadeayne, all of Cornwall, N. Y.

Hero Electric Company, Union Hill, Hudson County, N. J.; capital stock, $50,000; the manufacture and sale of electric batteries and other electrical apparatus; promoters, J. H. Wood, Jersey City, N. J.; J. B. Varick, D. P. Westerfelt and A. W. Tobey, all of Union Hill, N. J.

The Munsie-Coles Electric Railway Equipment Company, Jersey City, N. J.; capital stock, $500,000; The construction and running of electric circuits for contact either above or underground, for railways and other purposes; promoters, R. H. Sherwood, Bensonhurst, N. Y.; J. B. Campbell, Brooklyn, N. Y.; T. C. Wellman, Bergen Point, Hudson Co., N. J.; T. L. Coles, Sr., New York City, N. Y.; J. F. Munsie, Brooklyn, N. Y.

The Hanson Battery, Light & Power Co. (Incorporated in W. Va.), Washington, D. C.; capital stock, $1,500,000; producing and furnishing electricity for light and power; promoters, Walter Hanson, 236 Pennsylvania Ave., Washington, D. C.; Luke Strider, 916 "F" St., Washington, D. C.; and Frank Aldrich, Mount Pleasant, D. C.

The Citizens Street Railway Co., Scottdale, Pa.; capital stock, $50,000; operating an electric road; promoters, S. C. Stevenson, A. C. Overholt, W. Newton Porter, all of Scottdale, Pa.

The Scottdale, Everson and Broadford Street Railway, Scottdale, Pa.; capital stock, $50,000; operating an electric road; promoters, Jno. R. Byrne, Everson, Pa.; A. C. Overholt and J. D. Hill, Scottdale, Pa.

Chartiers Valley Street Railway, Pittsburgh, Pa.; capital stock, $30,000; operating an electric road; promoters, James T. Wood, C. C. Morrow, H. T. Friend, all of Pittsburgh, Pa.

The Nickel Plate Street Railway Company of Scottdale, Mt. Pleasant, Pa.; capital stock, $12,000; operating an electric road; promoters, Joseph Herbst, Monroe Morrison and W. C. Morrison, all of Mt. Pleasant, Pa.

The North End Passenger Railway Co., Allegheny, Pa.; capital stock, $200,000; operating a cable or electric road from Fremont St. and Washington Ave. to Woods Run Ave. in the City of Allegheny, Pa.; promoters, Francis J. Torrance, 241 Western Ave., Wm. G. Graham, 139 North Ave., D. F. Henry, Stockton Ave., all of Allegheny, Pa.

Electro-Novelty Company, 39 Exchange St., Pontiac Me.; capital stock, $50,000; manufacturing and dealing in all kinds of electric novelties; promoters, Joseph B. Cupples, Longwood, Mass.; W. A. Connelly, John P. Cushing, Boston, Mass.

The Mifflinburg Electric Light and Power Company, Mifflinburg, Union Co., Pa.; capital stock, $1,000; supplying light, heat and power by means of electricity; promoters, Jas. H. Snodgrass, Jno. A. Beard, Aaron Klose, Wm. A. Ewing, Robt. E. Snodgrass, all of Mifflinburg, Pa.

Acme Light, Heat and Power Company, Chicago, Ill.; capital stock, $2,000,000; furnish light, heat and power; promoters, Geo. S. Knapp, James A. Turner and Simeon J. M. Bear.

National Electroprise Company, Limited, New Orleans, La.; capital stock, $250,000; to purchase and sell the electroprise and similar instruments; promoters, E. C. Fenner, Robt. Manson, John C. Febiger, New Orleans, La.

The Mott Visual Telegraph Company, Jersey City, N. J.; capital stock, $500,000; to manufacture, construct, complete, repair and sell electrical bulletin instruments; promoters, W. A. Vail, C. K. Smith, both of Brooklyn, N. Y.; C. R. Truex, B. Whitehorne, both of Montclair, N. J.; R. K. Brown, New York, N. Y.

Pascagoula Ice Company, Scranton, Miss.; capital stock, $15,000; manufacture electric lights, etc.; furnishing cold storage, etc.; promoters, L. T. Bell, Sr., F. McArdle, F. P. Rives, John Foster and Ed. Bloomfield.

Spher-Electro Power & Development Company, Portland, Maine; capital stock, $2,500,000; manfacture and deal in machinery, apparatus and appliances of all kinds; promoters, Aaron F. Smith, Lynn, Mass.; Chas. H. Tigh, Peabody, Mass.; Orlando E. Lewis, Boston, Mass.

The Wampa Electric Light and Power Company, Wampa, Idaho; capital stock, $24,000; construct and operate an electric plant for the distribution of light and power; promoters, J. N. Jones, P. W. Purdum, both of Wampa, Idaho; H. E. Simmons, Summit, N. J.

McLeod Electric Manufacturing Co., Brooklyn, N. Y.; capital stock, $3,000; manufacture of electrical machines, implements and specialties; promoters, James McBeth, 1309 Bedford Ave., Brooklyn, N. Y.; Joseph N. McLeod, 971 Kent Ave., Brooklyn, N. Y.; Chas. Van Winkle, 22 E. 7th St., Plainfield, N. J.

Heisler Electric Company, Gloucester, N. J.; capital stock, $250,000; manufacture and sell electrical apparatus; promoters, W. Shaphigh, Camden, N. J.; J. Ball, Philadelphia, Pa.; and F. H. MacMorris, Philadelphia, Pa.

Atlantic Electric Light and Power Company, Atlantic City, N. J.; capital stock, $50,000; manufacture, produce, supply and distribute electricity for electric lights; promoters, C. L. Cole, C. J. Adams, C. E. Brown, all of Atlantic City, N. J.

The Europe-American Electric Corporation, Chicago, Ill.: capital stock, $2,000,000; to acquire, manufacture and deal in electrical patents, inventions, devices, improvements and machinery; promoters, Frank Butterworth, Monroe L. Willard and Arthur A. Bliss.

New York Electric Construction Company, Jersey City, N. J.; capital stock, $100,000; to build, construct, enlarge or complete electric light plants and electric light devices; promoters, Thos. H. Howell, John H. Hapgood, Peter B. Vermilya and Geo. E. Hutchinson, all of New York City, N. Y.; Chas. S. Van Nuis, of New Brunswick, N. J.

The Union County Electric Company, Roselle, N. J.; capital stock, $30,000; to construct, acquire, maintain, operate, purchase and sell works and machinery of all kinds for transmitting electricity; promoters, H. P. Baldwin, Roselle, N. J.; H. M. Byllesby, St. Paul, Minn.; W. H. Moore, Plainfield, N. J.

The Springfield Light and Power Company, Springfield, Ohio; capital stock, $200,000; generating and distributing electricity for light, power, etc.; promoters, Allston Burr, C. H. Pierce, Jno. H. Miller, W. A. Scott, Geo. Martin.

The Columbus and Westerville Railway Company, Columbus, Ohio; capital stock, $100,000; constructing and operating a street railroad between Columbus and Westerville, Franklin Co., Ohio, to operate by electricity or other power; promoters, M. H. Neil, Lewis Hoffman, Adam G. Innis, Geo. W. Williams, G. W. Meeker, F. H. Houghton, J. W. Everal, E. H. Reasoner, C. E. Bell.

The Lake Erie Electric Light Company, Elyria, Ohio; capital stock, $20,000; manufacturing electric light and gas; furnishing the same for light, heat and power, etc.; promoters, Frank M. Townsend, Henry W. Worst, Sam Rawson, Chas. E. Wilson, W. L. Fay and Lester McLean.

Gray Electric Company, Chicago, Ills.; capital stock, $100,000; manufacture, sell and use telautographs, electrical and other instruments and appliances; promoters, Elisha Gray, Frederick W. Cushing and Leon O. McPherson.

The Chilian Junta on Saturday last allowed the reopening of cable communication between Valparaiso and Iquique, which has been suspended since July last.

Henry Villard, who is making a tour of the Northwest, said the other day in an interview at Spokane, Wash., that he believed before long all trains on the Northern Pacific Railroad would be operated entirely by electricity.

ELECTRICAL PATENT RECORD.

Letters Patent Issued Oct. 13 and 20, 1891.

DYNAMOS, MOTORS AND ACCESSORIES.

460,972. Rheostat. Otto A. Kessner, Newark, N. J.

461,105. Commutator Oiler. Fred L. McGahan, Indianapolis, Ind.

461,135. Electrical Inductional Transformer. William Stanley, Jr., Pittsfield, Mass.

461,139. System of Distributing Electric Energy. Rankin Kennedy, Glasgow, Scotland.

461,140. Dynamo Electric Machine. Rankin Kennedy, Kilmarnock, Scotland.

461,229. Electric Meter. George R. Balwin, New York, N. Y.

461,239. Switch Box. Horatio A. Foster, New York, N. Y.

461,240. Dynamo Electric Machine. Ezra T. Gilliland, New York, N. Y.

461,296. Armature for Electric Motor. Charles J. Van Depoele, Chicago, Ill.

461,297. Actuating Device for Moving Commutator Brushes. Charles J. Van Depoele, Lynn, Mass.

461,298. Electric Switch. Sterling P. Van Nort, St. Louis, Mo.

461,456. Electric Switch. Alfred Swan, Orange, N. J., assignor to the Insulite Manufacturing Company, New York, N. Y. Application filed Aug. 6, 1890.

461,526. Adjustable Transformer. Elihu Thomson, Lynn, Mass. Application filed April 17, 1889.

461,552. Field-magnet for Dynamo-electric Machines. Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric Railway and Motor Company. Application filed Jan. 19, 1885.
Claim 1 reads: In a dynamo-electric machine, the combination, with the series of longitudinal plates forming a field-magnet core, of the outer clamping-plates having extended portions and the cross-brace extending from one of the said extended portions to the other, substantially as set forth.

461,560. Snap-switch. Henry P. Ball, New York, N. Y., assignor to the Edison General Electric Company, same place. Application filed March 2, 1891.
This invention relates to that class of knife switches, where the blade of the switch is gradually withdrawn from the jaws till the point of breaking is reached and then suddenly opened by a spring.

461,561. Snap-switch. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Application filed April 18, 1891.

461,569. Arc-lighting System. Robert S. Dobbie, Brooklyn, N. Y. Application filed April 8, 1891.

461,575. Electric Meter. Albert B. Herrick, New York, N. Y. Application filed Oct. 16, 1890.

461,761. Electric System. George R. Lean, Boston, Mass., assignor to the Bernstein Electric Company, Portland, Maine. Application filed Jan. 17, 1891.

461,791. Automatic Electric Switch. Sigmund Bergman, N. Y., assignor to the Bergmann Manufacturing Company, same place. Application filed Feb. 29, 1891.

461,795. Armature for Electric Motors or Dynamos. Robert Lundell, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Application filed April 4, 1891.

LAMPS AND ACCESSORIES.

460,968. Fuse Box for Electric Lamps. Arnold B. Holmes, Boston, and Geo. F. Gale, Winthrop, Mass.

460,991. Incandescent Electric Lamp. Albert L. Reinmann, New York, N. Y.

461,144. Electric Arc Lamp. Elihu Thomson, Swampscott, Mass.

461,420. Spring Cushioned or Suspended Arc Lamp. Charles F. Brush, Cleveland, Ohio, assignor to the Brush Electric Company, same place. Application filed May 26, 1890.

461,659. Electric Arc Lamp. Aloys Wirsching and Rupert Schefbauer, New York, N. Y. Application filed Nov. 13, 1890.

461,706. Incandescent Double-key Lamp-socket. William J. McCutcheon, Jr., Pittsburgh. Application filed March 21, 1891.
Claim 1 reads:—In a double incandescent lamp socket, a frame to receive the lamp, contact-points and conductors for two filaments, and two keys arranged concentrically, each key moving independently of the other and provided with suitable contacts, the parts combined substantially as described.

461,797. Incandescent Lamp Filament. John T. Marshall, Metuchen, N. J., Assignor to the Edison Electric Light Company, New York, N. Y. Application filed Nov. 9, 1885.

CONDUITS, CONDUCTORS AND INSULATORS.

461,272. Electric Conductor. Frank A. Perret, Brooklyn, N. Y.

461,467. Composition of Matter For Insulating Purposes. Marcus O. Farrar and Charles C. Howe, Bristol, N. H. Application filed May 6, 1891.

461,549. Conduit and Conductor for Electric Railways. Walter H. Knight, New York, N. Y. Application filed April 29, 1887.

461,562. Electric Wire Connection. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Application filed May 12, 1891.

461,563. Electrical Connecting Device. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Application filed June 13, 1891.

461,568. Coupler for Electric Wires. James H. Delany, South Orange, N. J., assignor to the Edison General Electric Company, New York, N. Y. Application filed Dec. 29, 1890.

461,631. Insulating Support for Electric Conductors. Robert J. Hewitt, St. Louis, Mo. Application filed July 30, 1891.

461,677. Electrical Conduit. Edwin T. Greenfield, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Application filed May 11, 1891.

RAILWAYS AND ACCESSORIES.

460,942. Trolley Catcher for Electric Cars. William L. Brown, Boston, Mass.

460,967. Track Rail for Electric Street Railway. John T. Hill and Bernard Meiring, Cleveland, O.

461,052. Electro Magnetic Brake. Alton J. Shaw, Milwaukee, Wis.

461,057. Electric Railway. Barton R. Shover and William C. Dickson, Indianapolis, Ind.

461,228. Electric Car Motor. George Willett, Englewood, Ill.

461,548. Contact-plow for Electric Cars. Edward M. Bentley, Brooklyn, N. Y. Application filed Nov. 21, 1885.

461,582. Hanger for Overhead Wires. Charles A. Lieb, New York, N. Y., assignor to the Sprague Electric Railway and Motor Company, same place. Application filed August 30, 1890.
This invention relates to the combination of an insulated bell-shape support and a trolley clamp for supporting an overhead wire.

461,611. Trolley-switch. Charles E. Hudson, Leominster, Mass., assignor to the Pierce Brothers & Company, same place. Application filed Jan. 13, 1891.

461,685. Electric Railway. Frank Mansfield, New York, N. Y. Application filed Nov. 18, 1890.

461,690. Electric Railway. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Application filed April 24, 1890.

461,770. Electric Railway Brake. Augustin I. Ambler, Washington, D. C., assignor to Rosline N. Ambler, same place. Application filed Dec. 18, 1890.

461,785. Trolley Wire Support. Leroy S. Prouts, Canton, Ohio, assignor of one-half to William J. Piero and Fred W. Bond, same place. Application filed July 3, 1891.

TELEGRAPHS AND TELEPHONES.

461,152. Telautograph. Max Soblik, Berlin, Germany.

461,470. Telautograph. Elisha Gray, Highland Park, Ill. Application filed June 13, 1889.
This invention relates to devices whereby drawings, plans, manuscripts, printed matter, and the like may be exactly reproduced at a distance.

461,471. Art of Telegraphy. Elisha Gray, Highland Park, Ill. Application filed July 19, 1889.

461,472. Art of and Apparatus for Telautographic Communication. Elisha Gray, Highland Park, Ill. Application filed Sept. 17, 1889.

461,473. Telautograph. Elisha Gray, Highland Park, Ill. Original application filed Sept. 17, 1889.

461,474. Telautograph. Elisha Gray, Highland Park, Ill. Application filed Sept. 22, 1890.

461,573. Telephone System. Claude C. Gould, Buffalo, assignor to the Eastern Electrical Manufacturing Company, Wheatfield, N. Y. Application filed May 5, 1891.

SIGNALS AND ANNUNCIATORS.

460,958. Electric Signal for Railway Trains. Lawrence Dunn, Fort Smith, Ark.

461,075. Circuit Conductor for Electric Signaling Apparatus. Waldo L. Gates, Springfield, Mass.

461,104. Electric Signaling Apparatus. Eugene G. Mettler, Indianapolis, Ind.
Claim 1 reads:
"An electric signaling apparatus comprising an electro magnet set in the main circuit between the dynamo and the mechanism to be operated upon, the core of such magnet, weighted and provided with a numbering tag at its lower end, its upper end connected with a steam whistle, the latter suitably connected to the steam supply.

461,279. Watchman's Electric Time Recorder. Fred W. Schiefer, Buffalo, N. Y.

461,371. Fire Alarm Apparatus. William C. Shaffer, Milwaukee, Wis.

461,748. Annunciator. Lambert F. Fouts, Trinity Mills, Texas. Application filed June 5, 1891.

461,760. Electric Clock Signal System. John La Burt, New York, assignor of one-half to William H. Agricola, Brooklyn, N. Y. Application filed July 14, 1891.

BATTERIES.

461,023. Electric Battery. Daniel M. Lamb, Boston, Mass.

461,024. Composition for Electric Batteries. Daniel M. Lamb, Boston, Mass.

461,025. Electric Battery. Daniel M. Lamb, Boston, Mass.

461,026. Compound for Electric Batteries and Method of Preparing the Same. Daniel M. Lamb, Boston, Mass.

461,027. Electric Battery. Daniel M. Lamb, Boston, Mass.

461,262. Galvanic Battery. Philipp Hieronymus, New York, N. Y.

461,437. Thermo-electric Element. Charles W. Iden, New York, N. Y., assignor to the Thermo Electric Company, of West Virginia. Application filed May 13, 1891.

MISCELLANEOUS.

460,862. Electro Magnetic Separator. Gustave M. Gouyard, Leadville, Colo.

460,978. Electric Soldering Iron. Willis Mitchell, Malden, Mass.

460,979. Electric Soda Fountain. Willis Mitchell, Malden, Mass.

460,980. Electric Heating Core for Smoothing Irons. Willis Mitchell, Malden, Mass.

461,076. Electric Parlor Game. Waldo L. Gates, Springfield, Mass.

461,087. Electric Automatic Fire Extinguisher for Buildings. William H. Soley, Philadelphia, Pa.

461,089. Fire Extinguisher. James Wolstencroft and William H. Soley, Philadelphia, Pa.

461,122. Electric Door Operating Device. Robertus F. Troy, Madison, Wis.

461,294. Automatic Electric Pump. Charles J. Van Depoele, Lynn, Mass.

461,295. Electrically Actuated Pump. Charles J. Van Depoele, Lynn, Mass.

461,355. Electrical Drop Bar for Doorways. Benjamin Lyons, Kansas City, Mo.

461,423. Electric Clock Winder. James DuLaney and Charles F. Dulaney, Canton, Ohio. Application filed Feb. 12, 1891.

461,424. Circuit-closer for Clock-winding Mechanism. James W. Dulaney, Canton, Ohio. Application filed May 13, 1891.

461,493. Electric Elevator. James E. Byrne, Boston, Mass. Application filed Dec. 2, 1890.

461,554. Electric Valve-controller. John V. Stout, Easton, Pa. Application filed March 26, 1891.

491,555. Shunt-Magnet for Valve Controllers. John V. Stout, Easton, Pa. Application filed July 1, 1891.

461,570. Thermal Cut-Out. Lorenzo B. Favor, Gloucester, Mass., assignor to the Thermal Electric Company, same place. Application filed March 12, 1891.

ELECTRICITY.

VOL. I. CHICAGO. NOVEMBER 4, 1891. NEW YORK. No. 16.

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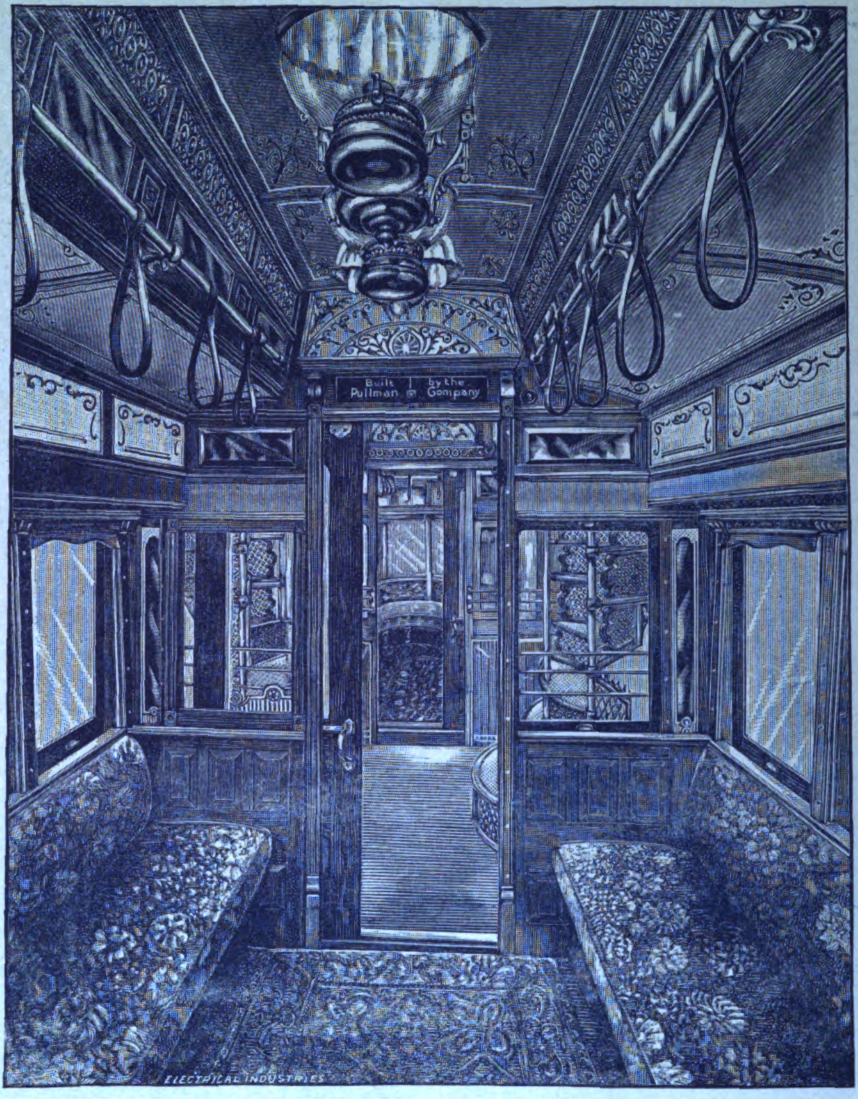

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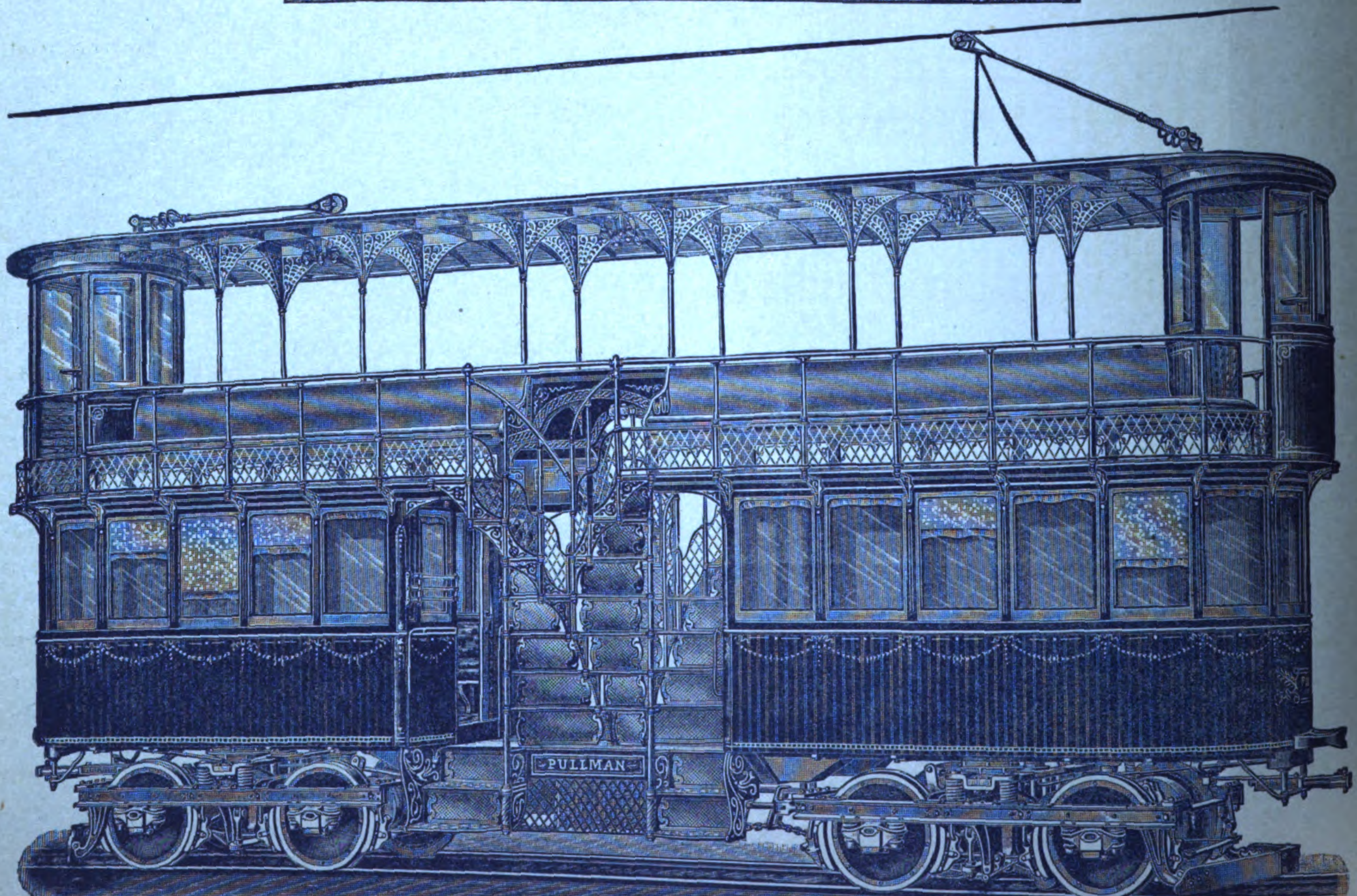

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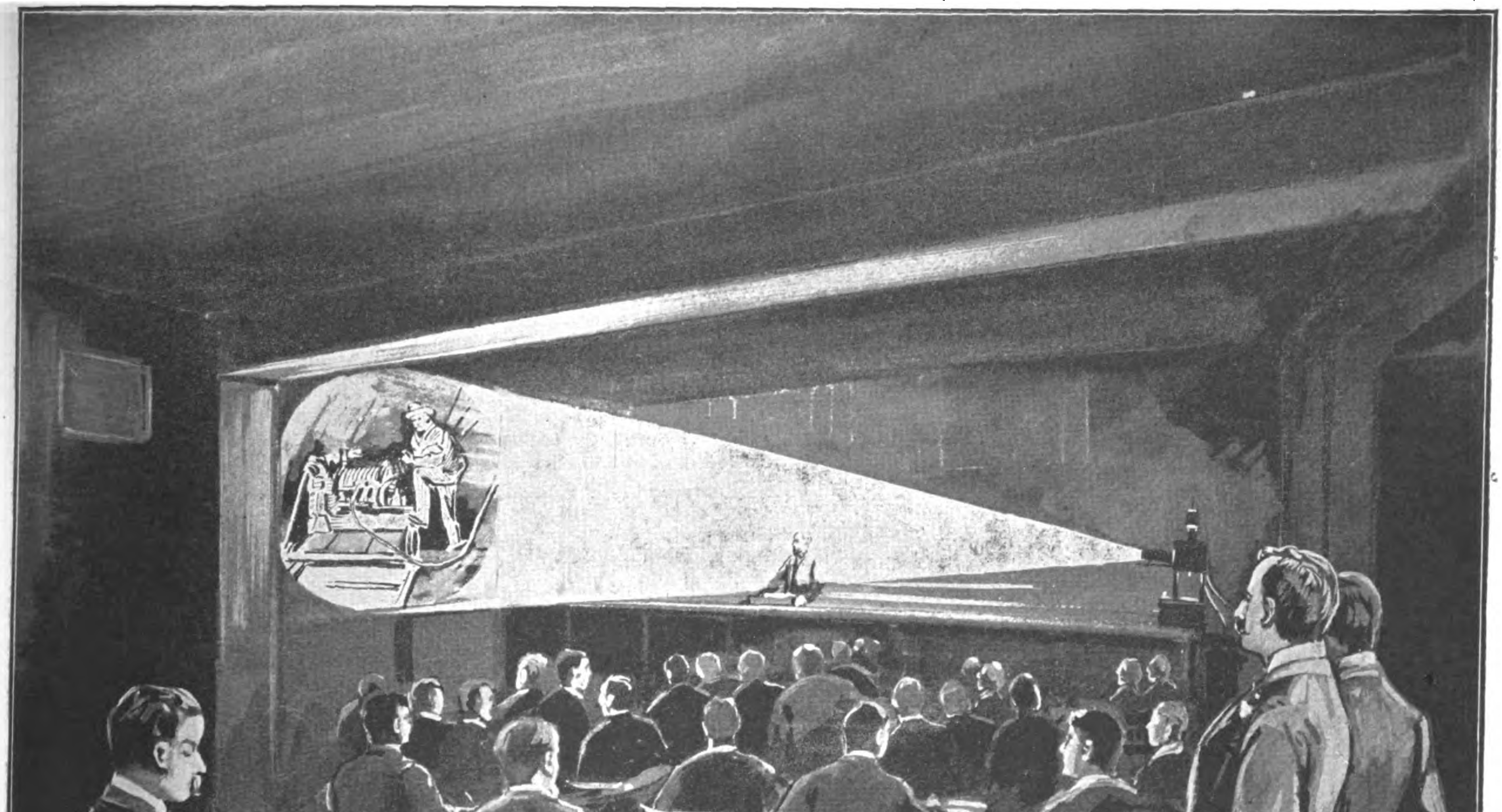


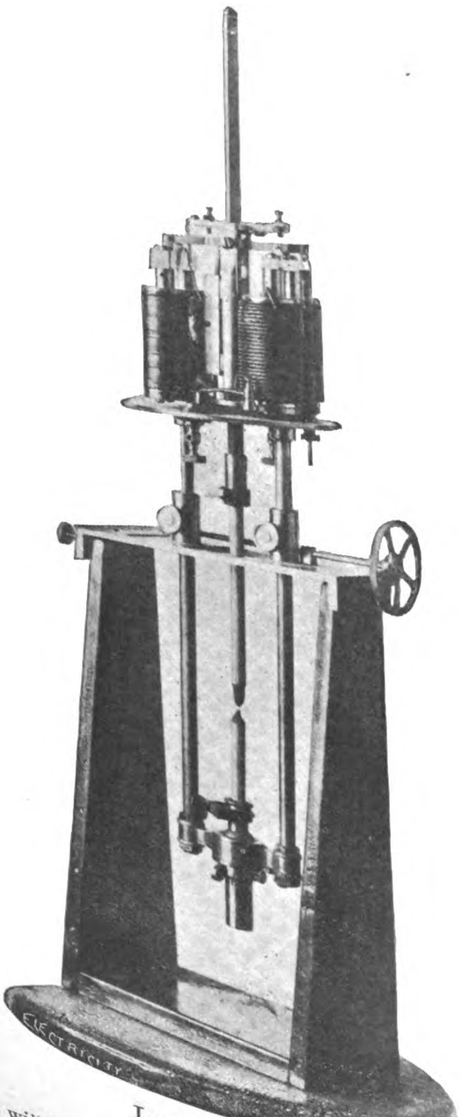
THE ARC LIGHT APPLIED TO A LECTURE LANTERN.

See page 204.

THE ARC LIGHT IN A LECTURE LANTERN.

During the ten years that electric lighting has been one of the great industrial applications of electricity, the arc lamp has been developed by the ingenuity of numerous inventors into a remarkably efficient piece of apparatus. Many uses have been found for it, and it has made its way into many situations where at first its introduction seemed to be impossible, or at any rate, undesirable. In the early days of arc lighting, the great objection to the lamp was found in its uncertain regulation, resulting in hissing, flickering and even in short periods of almost total extinction The arc lamps in use to day, however, give so constant and uniform a light that this objection has practically disappeared. So far as special applications are concerned, its younger rival, the incandescent lamp, has far outpaced the arc lamp. The special applications of the arc, indeed, might easily be numbered on the fingers of one hand, whereas those of the glow lamp are almost bewildering in number.

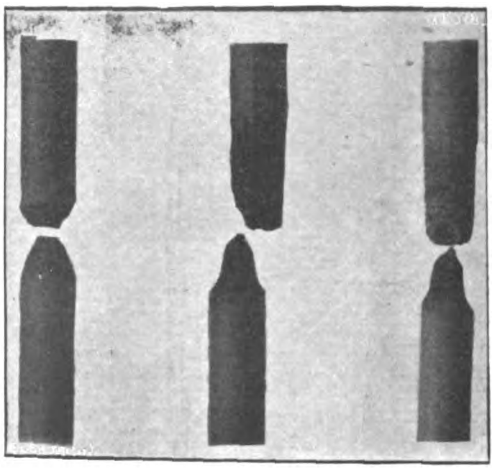
On account of the intense light given by the electric arc many workers in this field have endeavored to apply it as a substitute for the oxy-hydrogen lamp used for lecture room purposes.



LAUDY ARC LAMP.

It will readily be seen that there are numerous difficulties in the way of a practical solution of this problem. Obstacles are found both in the regulation of the carbons and in their relative position to each other, and in keeping the supply of current to the lamp constant.

Some nine or ten years ago, Mr. Douglas experimented with a light at the South Foreland lighthouse, in which, by an ingenious arrangement of the carbons, the crater of the arc was maintained constantly in the same relative position to the centre of the lens, and furthermore, the crater reflected the light forward, so that almost the entire amount of light emitted by the arc was thrown towards the lens. The results



POSITION OF CARBONS.

of his experiments were as follows: Taking the light given in a horizontal plane with the direct vertical arrangement of the carbons as 100, he found the light given towards

the East or front equaled	287
North or side "	116
South or side "	116
West or back "	38
Mean	139

Dr. L. H. Laudy, of Columbia College, has adapted this arrangement of the carbons to lecture lanterns.

It is obvious in this that the ordinary position of the carbons in the arc lamp has been very much modified, as the crater, of course, generally throws the light downward instead of to one side. This peculiar position of the crater is obtained by placing the carbons in such manner that the axis of the upper or positive carbon coincides with the edge of the lower carbon furthest from the lens. The regulation of the carbons is on the principle of a focusing lamp, the arc always being in the same position in space. This is effected by a double movement of the positive carbon to a single movement of the negative, as the two are brought near to each other to compensate for the burning away of the carbon. The feed is perfectly constant and so long as care is taken to maintain the voltage at the required figure, the lamp will be perfectly free from hissing or flickering. As a consequence of this the variation in the intensity of the light is practically nil, and the intensity of a given lamp can be estimated within very narrow limits.

In connection with this electric lecture lantern several interesting points regarding its ready adaptability for the work are deserving of mention. Any lantern that has been used with the oxy-hydrogen light can easily be altered to carry the arc lamp. Other electric lamps for this class of work have generally required special cases of a more or less cumbersome nature. The oxy-hydrogen light requires considerable skill in manipulation and occupies a good deal of time to set up and keep in working order. The arc lamp is adjusted in a few seconds, and when once started the regulation is entirely automatic, no special skill being necessary in using it beyond the ordinary electrical knowledge requisite for the handling of an electric light of any kind. A further and very important advantage in favor of the arc lamp for lantern use is its extreme economy. It is found as the result of careful experiments that the oxy-hydrogen light costs about $1.50 per hour, whereas the arc lamp can be run at a cost for current not exceeding 20 cents per hour; indeed, this is a liberal estimate at the ordinary meter rates for current.

THE VOLTAGE OF LIGHTING AND POWER CIRCUITS.

BY J. STANFORD BROWN.

The question of the voltage of circuits furnishing current for light and power should, one would suppose, be pretty thoroughly understood by all electric light and power men, and the terms used by each should have the same meaning; yet such does not seem to be the actual case.

When "A" comes in to buy a motor, one of the first questions asked him is: "what voltage do you want?" He does not know. "Well, what circuit are you going to run it on, the Edison?" "Yes." "Then you want a 220 volt machine.' Nine men out of ten would consider the matter settled and they would be mistaken.

Had the gentleman ordered a compound-wound 110 volt dynamo for an isolated incandescent plant, without further specification, he would have been supplied with a machine maintaining its terminal pressure constant at 110 volts under varying load.

An agent sending in an order to the home office, always has to specify when he wants a machine "over-compounded" for 5, 10 or 15 per cent. "drop" as the exigencies of his wiring plans happen to demand.

In short, a 110 volt circuit is one that has a potential difference of 110 volts *somewhere*. It may be at the dynamo end, it may be at the lamp end. It might be at both ends, but such a circuit exists as a rule only in the "text books."

Were it a central station circuit, it might mean 110 volts at the lamps and it might not, according to whether the drop was such as to demand at the point under consideration a 110 or a 100 volt lamp.

The difference between 100 and 110 volts of course will have no appreciable effect on a motor cut into such a circuit, provided the lights and the light customers can stand the variation of pressure when the power work starts and stops.

But let us take an extreme case. Not long since, a man bought a motor to run on a "110 volt" circuit. At least, he was informed that the circuit was operated at that pressure. He had been renting the identical machine when it was running on the circuit of another company whose station had been temporarily shut down, and he had been charged for it at so much a month. When he started upon the new company's mains, everything went smoothly until the bill came in. He was now paying for current by meter. The price was nearly double what it had been, while the work he was doing was exactly the same as before. He could not, he would not, stand it. It did not pay him to run a motor at such heavy cost. He would go back to his old oil engine which had stood rusting for two years. The central station man said it was the motor—the motor was "no good;" it took too much current; buy one of "our" motors and you will be all right. Well all that might be true, but he had not yet paid for the motor he had, and he therefore proposed to interview the man of whom he had purchased it before buying another one. That man said the motor was all right, and that the central station agent was simply "playing him" to sell him a new motor. Furthermore he offered to pay for an expert test in case it could be shown that the motor took more current than the average commercial machine for the same power developed. To cut the story short, the voltmeter showed the 110 volt motor (*i. e.* wound to regulate at a constant terminal pressure of 110 volts) trying to develop 2 h. p. on a potential difference of only 52 volts.

A central station that could collect bills on the above plan, would pay beautifully so long as no experienced customers were connected.

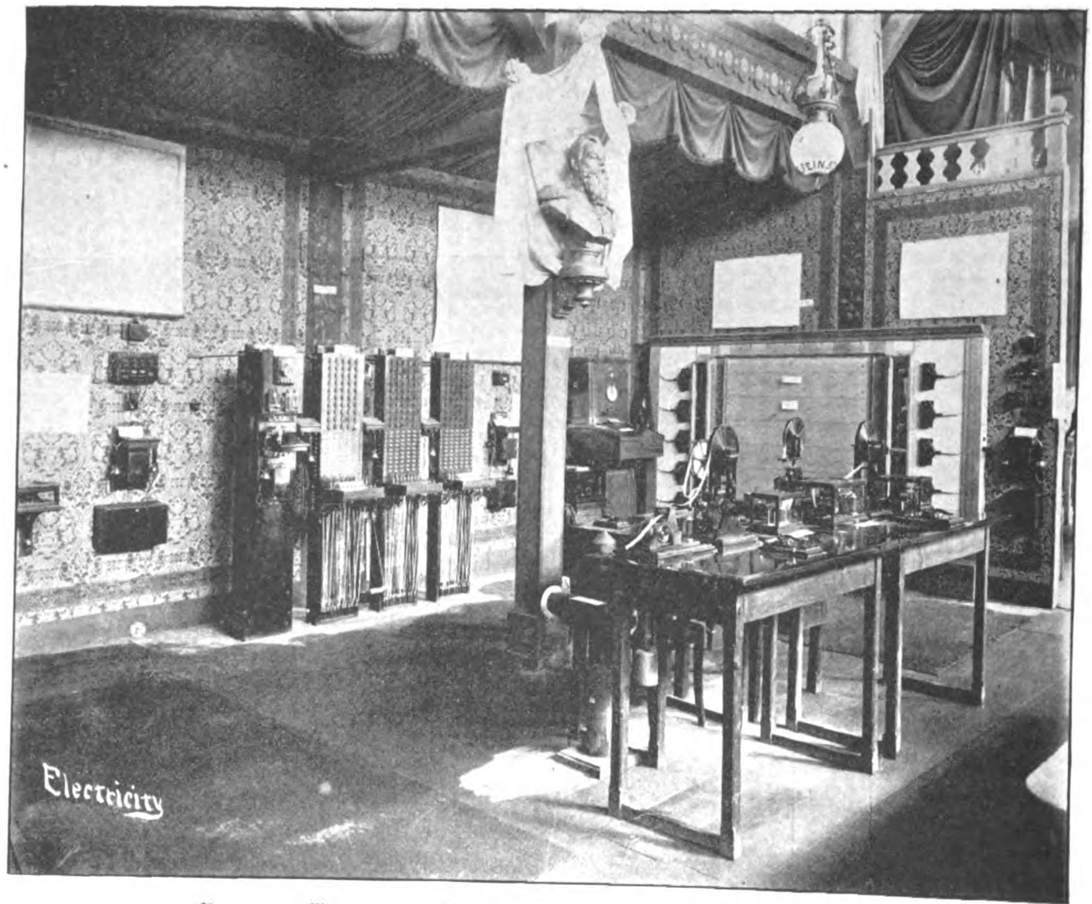
ELECTRIC STREET RAILWAY WORK IN CHICAGO.

The Love Electric Traction Company, of Chicago, expect to break ground this week for the experimental track which they intend to lay on Fullerton, Racine and Webster avenues and Halsted street, near the northern limits of the city.

When this loop is finished it is intended to show the operation of the Love electric street car system. If found practical it will undoubtedly replace the cable used on the North Side street car system.

A NEW SUBMARINE BOAT.

La Marine Francaise contains a description of the new Portuguese submarine boat designed by Dom Fontes Pereira de Mello, which possesses features not to be found in the boats hitherto constructed. The boat has a length of 72 feet, a diameter of 11 ft. 2 in., and a displacement when submerged of 100 tons. Power is furnished by a motor, working from accumulators, which drives a pair of screws and gives a speed of six knots, maintainable for fourteen hours. The boat is submerged by introducing water ballast into reservoirs, and by horizontal propellers, its perfect stability under all conditions being insured by a special arrangement. When submerged, direct communication is kept up with the outer air by means of a long hose, which admits 40 cubic metres of air per hour, and allows of the free respiration of natural air. The dome is furnished with an optical tube 16½ feet long, and slightly over four inches in diameter, within which a set of mirrors reflect the image of the object to be observed and magnify it before meeting the eye of the observer. This apparatus is so arranged that it allows of measurements being taken within certain limits, with sufficient accuracy. The armament consists of four large electric controllable Nordenfelt torpedoes, capable of holding a charge of from 260 to 530 pounds and having a radius of action of some 4,000 yards. The boat is intended exclusively for coast defence, and to be anchored under water where, with its observation tube, it would have an offensive radius of action extending over 4,000 yards in every direction. The special advantages claimed for the new boat over all others are its absolute stability, even when submerged in a strong current; free respiration without the necessity for reservoirs of compressed air and consequent ability to remain under water for lengthened periods, and finally, the optical apparatus which permits of a good look-out being kept when the boat is under water and of distances being accurately measured.—*Review of Reviews.*



BAVARIAN TELEGRAPH EXHIBIT AT THE FRANKFORT EXHIBITION.

THOMSON-HOUSTON EXHIBIT AT THE FRANKFORT ELECTRICAL EXHIBITION.

NOTES FROM THE FRANKFORT ELECTRICAL EXHIBITION.

BY FRANK C. PERKINS.

The German government has made several exhibits, showing in every detail the different types of telegraph apparatus used in the government telegraph, telephone and railway services. One of the accompanying illustrations gives a view of the exhibit of the Royal Bavarian Telegraph and Telephone Department. The bust in the background is that of Luitpold, Prince Regent. Among other governmental exhibits are those of the Imperial German Post Office, of Berlin, and the Royal Prussian State Railways. An interesting portion of the government exhibits is devoted to telegraphic and telephonic appliances for use in time of war. In Fig. 2 is an illustration of a portable telephonic outfit for an outpost or sentinel enabling him to communicate directly with headquarters. This outfit consists of a knapsack containing a reel of insulated double-conductor wire, which the sentinel pays out along the ground as he goes to his post. His portable telephone is connected to the wire and in this way he is in constant communication with the main force.

So far the Lauffen-Frankfort transmission has been carried on without serious interruption. On one occasion the turbine regulator failed to work, owing to the breaking of a cog; the result was that the speed of the generators immediately increased and a bank of two hundred incandescent lamps was burned out, the pressure on the lamp circuit having risen from fifty to ninety volts. The insulation of the line has given no trouble

the present, the line pressure being now about 16,000 volts. During a severe rainstorm in October this pressure was maintained without the insulation giving way at any point, and the motor and lamps received their proper supply of current throughout the evening. It is intended to continue experimenting with the Lauffen-Frankfort transmission for some time after the close of the exhibition. Up to now the pressure has only once been raised above 16,000 volts, but the intention is to increase it to the highest point possible, say up to 50,000 volts, in order to ascertain whether the insulation will stand such an enormous strain.

The exhibit of the Actien Gesellschaft of Schaeffer and Walcher, of Berlin, comprises a magnificent display of fine art metal work for electric light fixtures, both for arc and incandescent lamps. This firm manufactures a great variety of these artistic fixtures, a branch of the electrical industry which, in Germany, they have made peculiarly their own. The illustration gives an excellent view of the striking fixtures exhibited.

The exhibit of the Thomson-Houston Electric Company, a general view of which also forms the subject of one of our illustrations, has excited very general interest among the German visitors. Many of the German engineers who do not fully understand the principles of the arc lighting apparatus used by the Thomson-Houston Company shake their heads as they look at the sparking of the arc machine and express the opinion that the commutator would have to be renewed about every other day! On account of the laws of this country series arc lighting has not been adopted to any great extent, the use of high pressures being forbidden. The system generally adopted of working arc lamps in paralled with resistance in series with the lamps is very uneconomical.

The German Emperor recently paid a visit to the Exposition and spent some three or four hours looking over the exhibits, even taking the trouble to see all the side shows.

President Samuel Gompers, of the American Federation of Labor has issued a call to the electrical wiremen's and linemen's unions of America to meet in Lightstone Hall, St. Louis, Nov. 21, for the purpose of organizing an international electrical wiremen's and linemen's union.

Electric Light Fixture Exhibit at the Frankfort Electrical Exhibition.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

Secretary Hornsby, of the Department, returned last week from his six weeks' tour of the principal countries of Europe. Mr. Hornsby was sent abroad by the Director General as a special commissioner from the Electrical Department, to investigate the exhibition at Frankfort and also to secure exhibits for the Exposition. An official report of the trip will be made to Director-General Davis next week. That it will be satisfactory may be surmised from the fact that Mr. Hornsby travelled over 13,000 miles and visited all the important electrical centres in Europe, including such cities as Cologne, Berlin, Paris, London, Liverpool and Nuremburg. In these cities he met all the prominent electricians whose names are familiar on this side of the Atlantic. "Competition is so great" said Mr. Hornsby in an interview, "that the electrical manufacturers who expressed their intentions to me of making an exhibit, required me to give my word that none of their competitors should be made aware of what they expected to do."

Several of the largest electrical manufacturers of Europe and America have recently made inquiries as to the possibility of their securing the necessary space in the Electrical department for very large exhibits. Among these applications are one from Europe, and one from an American firm, each asking for 50,000 square feet of space in the Electricity Building. It is certain that if all of the larger manufacturers of the world demand space in proportion to the size of their business, there will not be a tenth part of the room asked for.

One of the applications for space received by the Department of Electricity is from a Chicago lady who asks for 50 square feet in which she expects to show her method of removing wrinkles from the face by electricity.

At a meeting of the executive committee Chairman Clowry, of the committee on electricity, made a strong protest against the way his committee is being ignored. Mr. Clowry's idea was that all matters pertaining to electricity should be referred to his committee, and he so impressed the fact upon the executive heads that they agreed that the two committees should act jointly in settling all questions relating to buying machinery, purchasing supplies, etc.

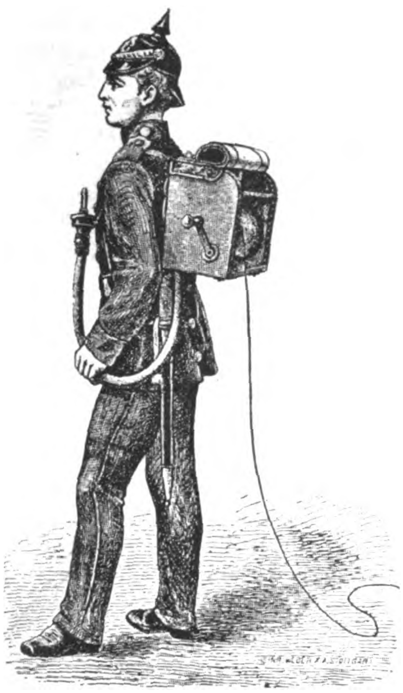
The temporary electric light plant has been tested and accepted. The plant, of which we give an illustration in another column, consists of two arc light dynamos of 50 lights capacity each, and two incandescent dynamos, all of the Edison company's make. Power is supplied from a 50 h. p. Phœnix and a 50 h. p. Ball engine. The companies have given the use of the engines to the managers of the Exposition free of charge. Power for running the saw-mills is to be furnished from this plant.

Orders have been given to all the contractors to remove their engines and substitute electric motors to generate the power necessary for sawing and planing the lumber used in the construction of the buildings. The principal reason for this sweeping order was the reduced rate offered by the insurance companies should the change be made. The directors believe that by making the

change they can save enough on the policies covering the buildings to furnish the necessary power free of charge to the contractors.

Electricity is to play an important part in the formal opening of the Exposition. This week the committee on ceremonies decided that instead of a large military or industrial parade, a night procession of a number of boats through the lagoons would be preferable. All the boats are to be artistically decorated and will fairly blaze with electric lights. Incandescent lights are to be arranged under the water and along the shore, which will give the boats the appearance of floating on a lake of fire. It is intended to repeat the parade every night, so that it will be possible for a larger number of people to see the grand spectacle than if it were to take place during the day. In this way the committee expect to make electricity occupy a position that would be impossible during a daylight parade. Among the floats in the procession will be one devoted exclusively to illustrating the telegraph and other electrical appliances.

Chief Burnham has asked for proposals from the manufacturers of police telegraph and telephone and fire alarm systems for installations in the grounds and buildings of the Exposition. All bids must be in by Nov. 3.



Portable Telephone Outfit for Army Use.

Mr. Keller has received several communications regarding historical apparatus, and it begins to look as though this exhibit would be a credit to the department.

The following are the names of eminent electricians not now living, which the Committee on Electricity of the World's Columbian Exposition desire to have placed over the principal entrances of the Electricity Building:

Franklin, Galvani, Ampere, Faraday, Ohm, Sturgeon, Morse, Siemens, Davy, Volta, Henry, Oersted, Coulomb, Ronalds, Page, Weber, Gilbert, Davenport, Sœmmering, Don Silva, Arago, Daniell, Jacobi, Wheatstone, Gauss, Vail, Born, De la Rue, Joule, Saussure, Cooke, Varley, Steinheil, Guericke, La Place, Channing, Priestley, Maxwell, Coxe, Thales, Cavendish.

TRE ELECTROPHONIC PIANO.

BY FRANK C. PERKINS.

This peculiar musical application of electrical mechanism is the invention of Dr. R. Eisenmann and was exhibited at Frankfort by Dr. Nehab, of Berlin.

The apparatus may be attached to any piano and can be removed at any time without injuring the piano. By pressing on the keys of the piano, without striking them, more as in playing an organ than a piano, electrical connection is made with the apparatus. The springs begin to vibrate giving forth very fine, soft tones, in quality more like a zither than any other instrument, except that the tone may be continued as long as desired by manipulating a pedal which keeps the electrical contact closed. A chord, when struck, gives the same tones as without the attachment, but if the contact is kept closed the chord will continue as long as electrical connection is made. In playing simple chords and pieces, very fine effects and variations may be produced. First playing a few measures without the attachment and then making connection and playing the same again gives an effect similar to repeating the same strain on an organ at a great distance.

Current is obtained from a couple of small storage batteries, shown in the illustration. The batteries contain six or eight elements, and the pressure can be varied from eight to fifteen volts as desired. The current used is about two amperes. By varying the voltage from eight to fifteen volts the sound can be made soft or loud.

The construction and operation of the device are as follows. Above each string or each set of strings for a note, is placed an electro-magnet, so arranged that when the damper is lowered from the strings and the key is struck or pressed down contact is made, and by means of an interrupter the current, in passing through the magnets, causes the strings to vibrate and produce the tone desired. Of course as long as the contact is made and the damper is away from the strings tones will be produced. Mr. R. Eisenmann used several interrupters instead of one so that there

The Electrophonic Piano.

could be no chance of the interrupter refusing to work. A switch, which can be moved by the knee, is placed just under the edge of the key-board, for making electrical connection with the apparatus. The apparatus sells for 300 marks ($60).

This exhibit has been one of the most crowded at the exposition. The apparatus can be attached to an upright piano with equally good results. While the apparatus works well and seems to be a perfect success, it is noticeable that it frequently requires adjustment. With an expert always present it can be kept in working trim, but left in charge of inexperienced hands it is more than likely that it would easily get [illegible] repair—and probably stay so.

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The World's Fair Abroad. In recent issues of ELECTRICITY we have commented on the attitude of the London *Electrician* in regard to English exhibitors at the World's Fair. In a leading editorial the *Electrician* spoke disparagingly of American electrical machinery, and said that there was no good reason why English electrical engineers should exhibit, because superior quality would stand no chance against the McKinley Tariff. From the general tone of the article in the *Electrician* we deduced the implication that British electrical men had little to learn over here. The *Electrician* points out, however, that in this respect it was misrepresented, because in speaking of the electrical section of the Exposition it said that it would be the chief attraction, and that "There will be much to learn, and, perhaps, something to unlearn, and a harvest of knowledge will be reaped in a few months, which, without the Exhibition, would require months of journeying in palace cars." As the *Electrician* thinks that this meets the point raised, we willingly reproduce it, in justice to that journal and to put ourselves right with our many English friends.

* * *

Lighting Railway Tracks. It is encouraging to note that the city authorities are taking active steps to compel all the railway companies having tracks running into Chicago, to properly light all grade crossing where the tracks intersect public thoroughfares. The existence of an ordinance which gives the Commissioner of Public Works power to take such action has only recently been discovered, but the Commissioner has lost no time in calling the companies to account when once assured of his legal rights in the matter. Grade crossings are dangerous at any hour of the day, but they are trebly dangerous at night. The frequent accidents at grade crossings, almost invariably attended by loss of life, are a scandalous blot on railway management, and it is absolutely criminal to allow the crossings to remain unlighted at night. In justice to the railway companies operating from Chicago, it must be stated that several of them already have their crossings lighted by arc lights; the others appear to be willing to promptly comply with the instructions of the Commissioner of Public Works, and it is to be hoped that before long not a single railway crossing in or near Chicago will remain unlighted at night.

* * *

The World's Electrical Congress. The American Institute of Electrical Engineers has appointed a standing committee to formulate plans for the International Electrical Congress to be held in Chicago in 1893, in connection with the World's Fair. The Institute first mooted the question of an electrical congress for 1893 about two years ago, and, as Prof. Gray said in his recent paper, if the congress is to be held under the auspices of any single society, the American Institute of Electrical Engineers certainly has the best claim to the distinction. It is emphatically the representative electrical body of this country, its membership and influence are increasing daily, almost every name prominent in American electrical circles is to be found on its roll, and most of these names are as well known abroad as they are here. A committee of three, composed of Prof. Elihu Thomson, Mr. C. H. Haskins and Mr. F. L. Pope, has been appointed to come to Chicago to uphold the claims of the Institute. The local committee of the World's Congress Auxiliary to organize the electrical congress, of which committee Prof. Gray is chairman, has not yet been fully made up, but doubtless it will be before the arrival of the committee appointed by the Institute. We see no reason why a perfectly harmonious arrangement should not be made between the Institute and the local committee, whereby both will work together to promote the success of the World's Electrical Congress of 1893.

* * *

The Electric Motor Triumphant. In our regular weekly report of progress of the World's Fair Department of Electricity will be found the statement that the authorities have decided to substitute electric motors for the various steam engines now scattered throughout the grounds doing various kinds of work. This is as it should be, for even if there were no advantage from an economical standpoint in taking this step, it would still be in consonance with the spirit of the time and of the progress which the exposition is intended to demonstrate to substitute the new for the old. We have no doubt, however, that by this change a great advantage will be realized, not only in convenience, but in actual money saving. It is not unreasonable to expect, in manufacturing establishments where several engines have been employed, an actual saving of thirty per cent. by concentrating the steam plant at one place and carrying the energy through wires to the points where it is to be utilized. The present instance, where it is probable that power may be required to-morrow at a point far distant from where it is used to-day, should present peculiarly favorable conditions for the electric motor. It would be a happy circumstance if it could be said that the World's Columbian Exposition began to be educational before its buildings had been erected. The present step is just such a one as will make it possible to say this, and we congratulate those responsible upon the opportunity thus afforded. To reap the greatest advantages it will be necessary to keep a detailed account of every item of cost and expenditure, both in money and energy, and to balance the books by the amount of useful work accomplished. It will take time and trouble to do this, but the ends will undoubtedly justify the labor. In addition to the economical and educational features referred to, this step will enable us to brag a little bit—and what American does not like to brag—and say that ours was the first exposition actually constructed by electricity.

* * *

Subways For Washington. In this issue will be found an abstract of the report sent to the President by the commission appointed to inquire into the subject of burying the electric wires in the District of Columbia. The report will not be received very favorably by electrical engineers in general. It recommends the clay conduit which, by those who have had most experience in subway work, is considered far inferior to iron pipes. There is scarcely an electrical engineer or corporation in the country but will emphatically protest against the commission's endorsement of municipal control of electrical works. Electricians have already suffered too much at the hands of municipalities to relish any dealings with them other than those absolutely necessary. It will be noticed to their credit that the commission recommend a price for the rental of subways of only $370 per mile, about one-third of the subway rental charged in New York. That part of the report which deals with electric railways is positively ridiculous. It would be quite unprofitable to discuss the sayings of men who claim that it has been proved that the cable is cheaper than the trolley system.

* * *

Telegraphic Codes. Ever since submarine telegraphy became an established means of communication much ingenuity has been expended on the compilation of codes, partly for secrecy, but principally to abbreviate the messages and save money in rates. To such a fine point has codifying been brought in this latter direction that the telegraph companies are at their wits' end to maintain a proper equilibrium between the number of messages sent and the number of words transmitted; in other words, between the volume of actual business and the amount of revenue. All large commercial houses now use complicated codes, in which a single word of ten letters represents a sentence of ten, fifteen or twenty words. In this issue we print a code alphabet for transmitting figures by telegraph, the compiler of which has rather missed the point. He uses consonants to represent the units and vowels to represent the units, tens, hundreds, and so on. Thus, 2345 becomes "codifega," and 23456 "cudofigeha." We are afraid that this code will never come into general use, at any rate for international telegraphy, for the reason that the code words would cost more to transmit than the figures they represent. "Codifega" and "Cudofigeha" are not words, but code combinations of letters, and are taxed at the rate of three letters to a word. Thus, "codifega" would be counted as three words, whereas 2345 would be counted as two only. Similarly, "cudofigeha" would be counted as four words, while the figures it represents would be counted as two. In point of

accuracy such a code gains nothing, because figures are always repeated back, and errors are rarely made.

* * *

A Continuous Recording Phonograph. According to one of the many stories about the discovery of the principle of the phonograph that are to be found in print, Mr. Edison conceived the idea of a talking machine from a close inspection of the indentations on the tape of a Morse recorder. Curiously enough this very obvious suggestion has not hitherto been closely followed up and the commercial phonograph has been supplied to the public with the cumbersome and inconvenient cylinder. The cylinder has many objections whatever use the phonograph is put to. For reporting, or even for taking down long musical productions, the cylinder has to be changed frequently; in regular office work the same difficulty is met with, and cylinders accumulate very rapidly. The continuous recording tape, which can accommodate several long records without the necessity of interruption or manipulation, is a distinct improvement in the phonograph. The ribbon takes up very little space, it simplifies the adjustment of the instrument and does away with the necessity of a second machine for continuous work. An article by Mr. Eustace Oxley, describing the operations of the ribbon recording phonograph will be found in this issue.

AN IMPROVED PHONOGRAPH RECORDER.

BY EUSTACE OXLEY.

The principal objection to the use of the phonograph for regular commercial work is the limited amount of matter that can be recorded on a single cylinder. A dictation of considerable length, such as an article, a lecture or a sermon, involves the use of a number of cylinders, which is a very obvious inconvenience. To remove this difficulty a device, consisting essentially of a continuous recording surface, has been invented and patented by the writer and Mr. W. F. Cole, of Boston.

In this machine the record is made on a continuous ribbon, the upper surface of which is coated with a film of wax composition; thus the thick cylinder is entirely done away with. The

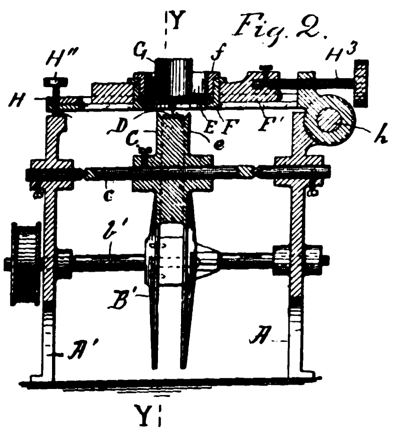


FIG. 2.—RIBBON RECORDING PHONOGRAPH.

accompanying illustrations and the description which follows explain the principle and operation of the improved phonograph.

The illustrations show a top view of the machine (Fig. 1), a sectional side view (Fig. 2) and a sectional front view (Fig. 3). In Figs. 1 and 2, B, B' are the reels which carry the recording ribbon; these are mounted on pinions b, b' set in bearings in the metal frames or side pieces, A, A'. C, (Fig. 2), is a small guide-roller, mounted on the shaft c, with its axis parallel to the axes of the reels B, B'. The shaft c, is held between centres, as shown in Fig. 2.

D (Figs. 1, 2 and 3), is the recording ribbon. It is carried around a portion of the guide-roller C, from the reel B, to the reel B', the direction in which it travels depending on whether the machine is recording or reproducing. The ribbon D, is coated on its upper side with a waxen composition, the coating being of uniform thickness on the whole surface of the ribbon. Above the guide-roller C, is placed the vibratory diaphragm E, with its stylus e; the diaphragm is secured in the case F (Fig. 2).

The case F, and the diaphragm E, are adjustable in a direction parallel with the guide-roller shaft s, so that the position of the stylus e, may be changed laterally in relation to the tape or ribbon D. When a record extending over the entire length of the ribbon has been made, the position of the stylus can be shifted slightly to one side and in this way a series of parallel records can be made on the same ribbon, thus allowing of its entire surface being utilized.

The diaphragm case, F, shown in the illustrations, is the ordinary diaphragm case used in the Edison phonograph. The case F (Fig. 2), is attached to a plate, F', which slides in and between the guide ribs h, h', on the cover H, which latter is hinged at H' to the frame A, and is provided at its opposite end with a regulating screw H'',

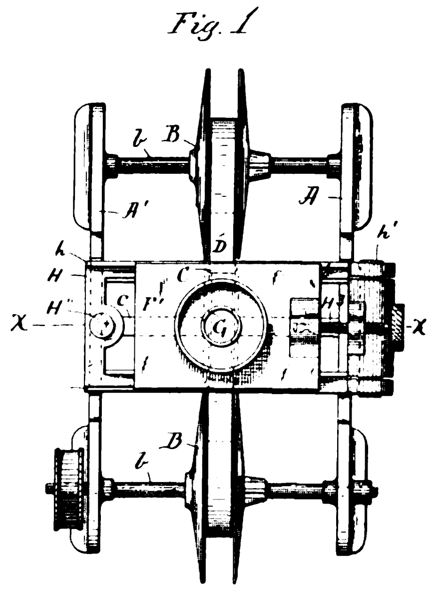


FIG. 1.

screwed through the cover H, with its lower end resting against a bearing on the frame A'. H^3 is a feed screw for adjusting the position of the slide F', with the diaphragm and stylus, relative to the ribbon D, for the purpose already described.

The reels B, B', may be set in motion by a small electric motor, clock-work or any other suitable mechanism. The speed of the ribbon is regulated by a governor, not shown in the drawings, so that it may be kept constant, while suitable means are also provided for holding the ribbon D taut while it is passing over the guide-roller. Small circular brushes are placed on each side of the guide-roller and in contact with the upper surface of the ribbon. These revolve when the machine is in operation, and sweep any shavings from the ribbon which otherwise might adhere to it and impair the record.

The operation of the machine is as follows: Suppose that the ribbon D is fed from one reel to the other and around a portion of the guide-roller. If during this movement of the ribbon the diaphragm be set in vibration, the vibratory movement of the stylus will be recorded on the surface of the travelling ribbon. After the entire length of the ribbon has been indented, the position of the diaphragm case, with its diaphragm and stylus, is adjusted so as to bring a fresh portion of the ribbon beneath the stylus, and this can be repeated until the entire surface of the ribbon is used up. To reproduce, the indented ribbon is fed back in contact with the stylus, the diaphragm is caused to vibrate and thereby reproduce the original sounds in the same manner as phonographs generally.

The advantages to be derived from the use of a

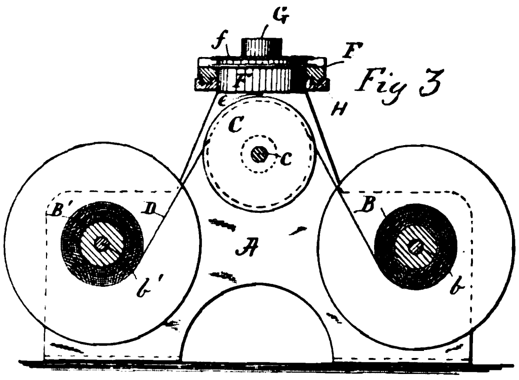


FIG. 3.

ribbon in place of a cylinder as a recording medium are many. It is safe to say that the use of a ribbon allows of greater simplicity of construction than is possible where a cylinder is employed. The use of the cylinder necessitates both a circular and linear motion relatively between the stylus and the recording medium; whereas with the ribbon a linear motion only is necessary.

The recording ribbon is lighter and less bulky than the cylinder; it is therefore preferable for transportation by mail or otherwise. It allows of a longer continuous record (what is meant by a continuous record is a record necessitating a comparatively long time for its delivery, such as a lecture, speech or musical performance), than is practicable with a single cylinder. In taking a long record with cylinders the machine must be stopped, the cylinder removed and a fresh one substituted, which necessitates readjustment of the various parts, all occupying time and causing loss of record. The machine would not be recording during the time occupied in making the adjustments, consequently during that time part of the record would be wanting. In order to obtain a continuous record with the cylinder phonograph it is necessary to have two machines in operation, using each one alternately.

On the ordinary cylinder now generally employed in phonographs, the greatest length of record, expressed in time, is considerably less than eight minutes. With a machine employing a recording ribbon an almost unlimited length of record could be made. A ribbon is not liable to be affected by variations in temperature, which tend to make the ordinary cylinders untrue and more or less inoperative and defective.

THE GRAY ELECTRIC COMPANY.

The company recently organized by Prof. Elisha Gray to exploit his telautograph, or writing telegraph system, has purchased fifty acres of land at Idlewild, a suburb of Chicago, on which to build an extensive factory. Plans for the first building, 60 x 146, have been completed and work will begin on it immediately. It is the intention of the company to place the buildings in the centre of the tract of land and arrange the remainder in the shape of a park. They will also build tenement houses for their employes.

On account of the growing business of the Chicago Edison Company they have found it necessary to increase their capital stock to $1,000,000. The numerous new office buildings that have recently sprung up within the limits of the Edison company's lighting district have nearly doubled the number of customers within the last two years.

ELECTRICAL EFFECTS AT THE "GROTTO" OF THE FRANKFORT ELECTRICAL EXHIBITION.

Some very remarkable and beautiful effects have been produced with the electric light in conjunction with the waterfall of the "grotto" at the Frankfort Electrical Exhibition. One of the illustrations shows the general arrangement of the grotto and falls by daylight. At night the tower and castle are illuminated within and their outlines traced with rows of incandescent lamps of different colors. On the miniature lake are boats decorated with garlands of incandescent lamps.

ARTIFICIAL WATERFALLS AND GROTTO AT FRANKFORT.

From the mouth of the dragon at the edge of the cave, issue streams of red fire, water and steam, while the grotto at the entrance to the cave is brilliantly lighted up with blue and green lights. The waterfalls are illuminated electrically in a manner similar to that adopted in the electrical fountains which are such an attractive feature of exhibitions. The color of the light is changed continuously, that of the small waterfall changing, for instance, from red to orange and white, while the large one changes from blue or orange and white, to red. The light is passed through the streams of water by means of large reflectors placed in recesses in the artificial rock. Fig. 2, shows the arrangements of mirrors and reflectors for the two falls. The water used in the falls is pumped up by powerful pumps driven by an electric motor; Fig. 3, gives a view of the pumping machinery. The electrical effects were designed, and the whole of the machinery and appliances constructed and installed by Schuckert and Co., of Nurenburg.

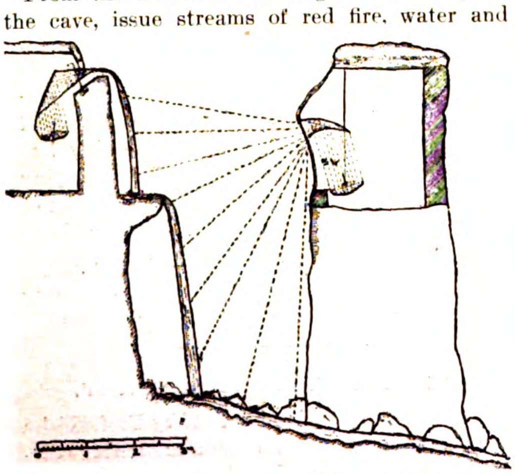
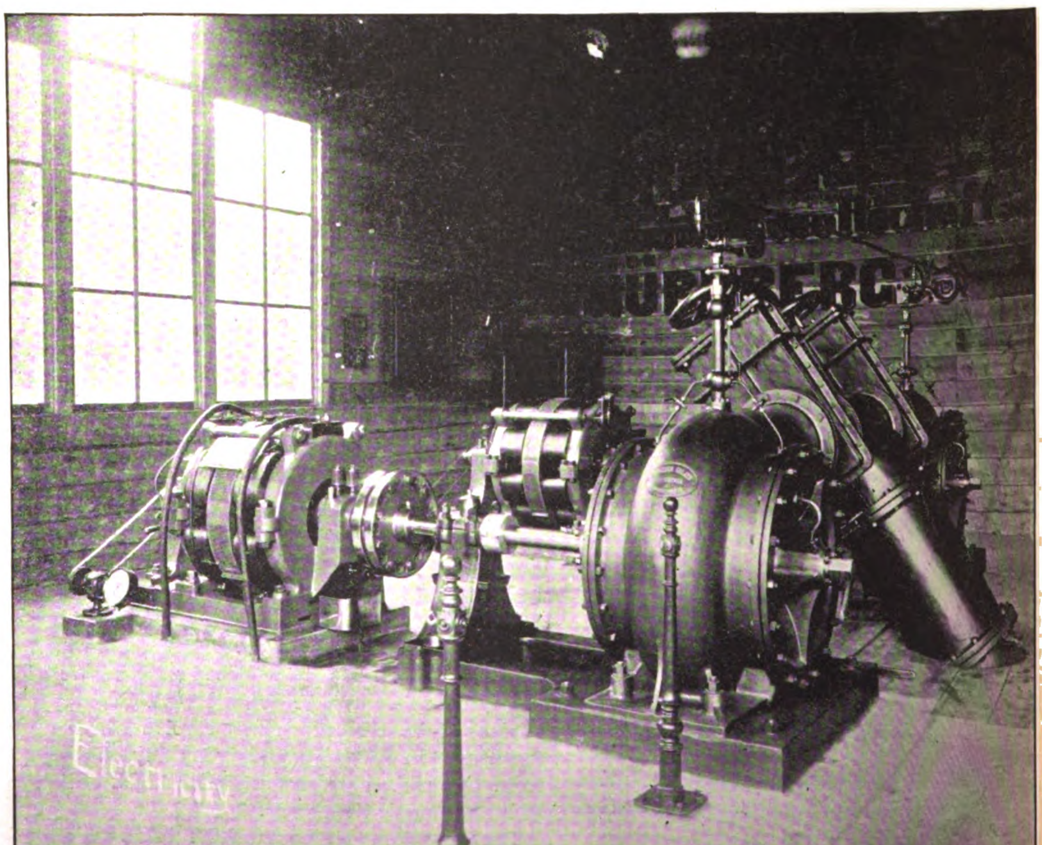


DIAGRAM OF LIGHTING ARRANGEMENTS.



ELECTRICALLY DRIVEN PUMPING MACHINERY.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

A meeting of the Institute Committee on the International Electrical Congress of 1893, was held in the office of the secretary, 12 West 31st street, New York City, October 27th. The committee is composed of the following members:

Edward Weston, Dr. S. S. Wheeler, Geo. A. Hamilton, Prof. Henry Morton, Prof. Chas. R. Cross, C. H. Haskins, R. W. Pope, Prof. W. A. Anthony; F. L. Pope, Prof. E. J. Houston, T. C. Martin, T. D. Lockwood, G. M. Phelps, C. O. Mailloux and Carl Hering.

The committee organized permanently and elected T. C. Martin, chairman, and R. W. Pope, secretary. It was voted that the members of the existing committee on Units and Standards be added to the Congress Committee, also the following members: Prof. Elihu Thomson, Prof. Alexander Graham Bell, Dr. E. L. Nichols, Mr. Nikola Tesla and Mr. Ludwig Gutman. A subcommittee of three was appointed by the chair, composed of Messrs. Carl Hering, W. A. Anthony and A. E. Kennelly, to formulate a provisional programme for the work of the Congress. The chairman is a member *ex-officio* of this committee.

It was recommended that the council appoint a committee to be sent to Chicago as soon as possible to represent the claims of the Institute to a leading part in the Congress, and to arrange for its co-operation with the authorities there upon a proper basis. The council subsequently appointed Prof. Elihu Thomson, Mr. C. H. Haskins and Mr. F. L. Pope as such committee.

At the meeting of council the following associate members were elected:

Capt. Achilles De Khotinsky—Electrician, Germania Electrical Company, 505 Exchange Bldg., Boston, Mass.

Robert Edward Dunston—President, the Connecticut Motor Company, Plantsville, Ct.

Edward T. Middleton—Instructor in Electricity and Physics, Rutgers College, New Brunswick, N. J.

Joseph T. Monell—With F. B. Crocker, 236 W. 22d street, New York City.

T. Carpenter Smith—Partner in firm of M. R. Muckle, Jr. & Co., 212 Drexel Bldg., Philadelphia, Pa.

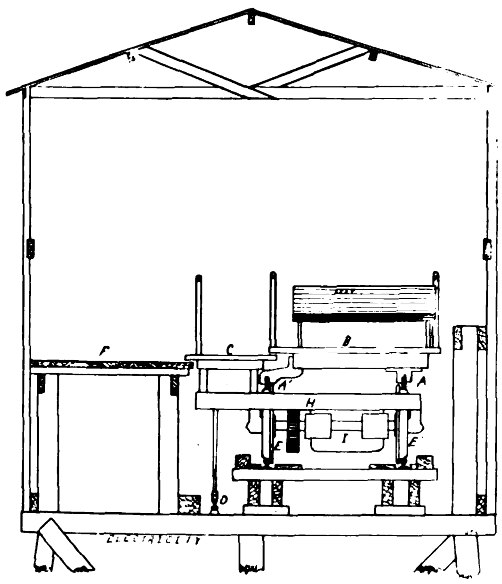
Frederick G. Strong—Electrician, Midland Electric Company, 1616, 17th street, Denver, Colo.

At the meeting of the Institute in the evening, Vice-President Lockwood presided. After the reading of a paper on "Magnetic Reluctance," by Mr. Kennelly, which was very freely discussed, the report of the Committee on Units and Standards was taken up, and after considerable discussion it was decided to take no definite action upon it at present. Professor Ryan communicated some corrections in his paper read at the September meeting, but on account of the lateness of the hour its further discussion was postponed.

THE COLUMBIAN MOVABLE SIDEWALK.

The probability is that during the six months of the World's Fair visitors at the exposition will not be compelled always to walk from one department to another, or from one end of the grounds occupied by the building to the other. Whether this is really to be so depends on the committee that was appointed to investigate the feasibility of adopting the plans of the Columbian Movable Sidewalk Company making a favorable report.

To prove to the satisfaction of the committee that the scheme is practicable, an experimental track has been erected at the north end of the exposition grounds and this track was tested this week, a number of interested persons and representatives of the press being present. To all appearances the test was perfectly satisfactory and the working of the sidewalk elicited a great deal of praise from those present.

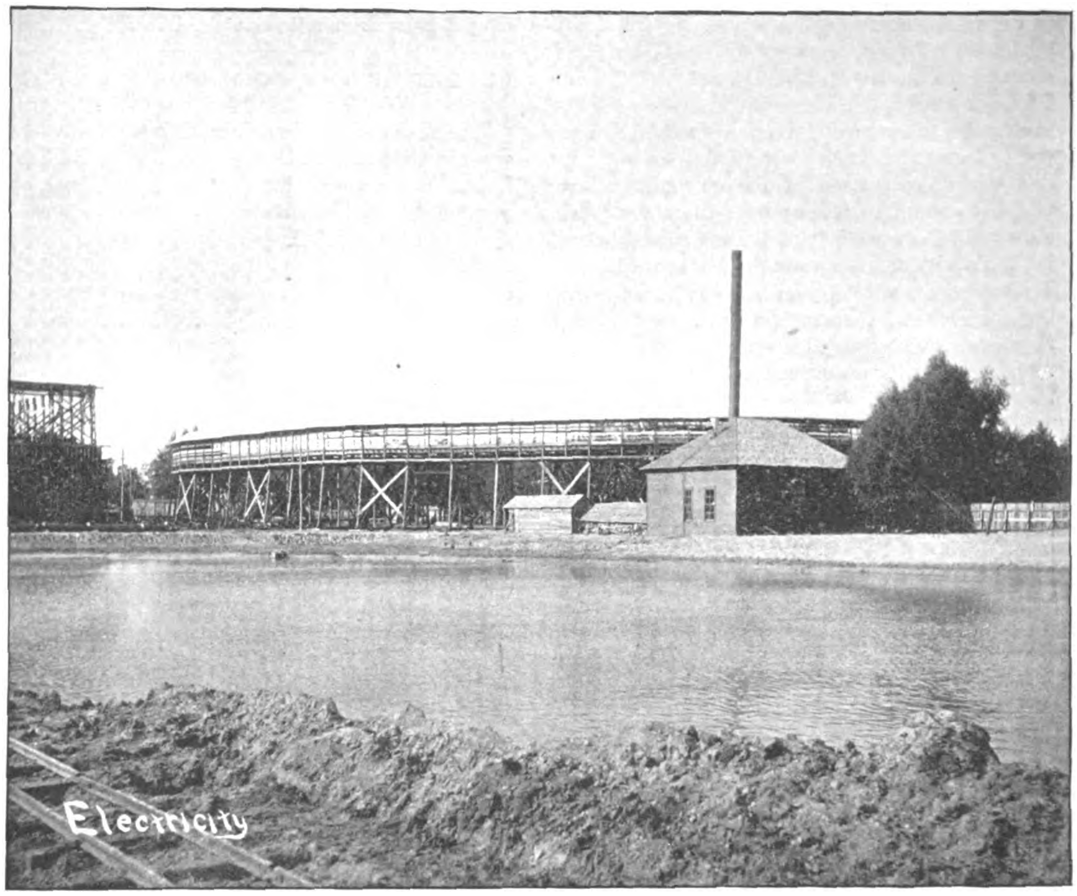


Movable Sidewalk, Fig. 3.

The experimental track is 900 feet long and elliptical in shape. It is elevated on a wooden structure twenty feet high, which is securely braced on all sides so that the motion of the cars is smooth and steady. A cover has been erected over the track to protect the passengers during stormy weather. Fig. 1 gives a general view of the structure.

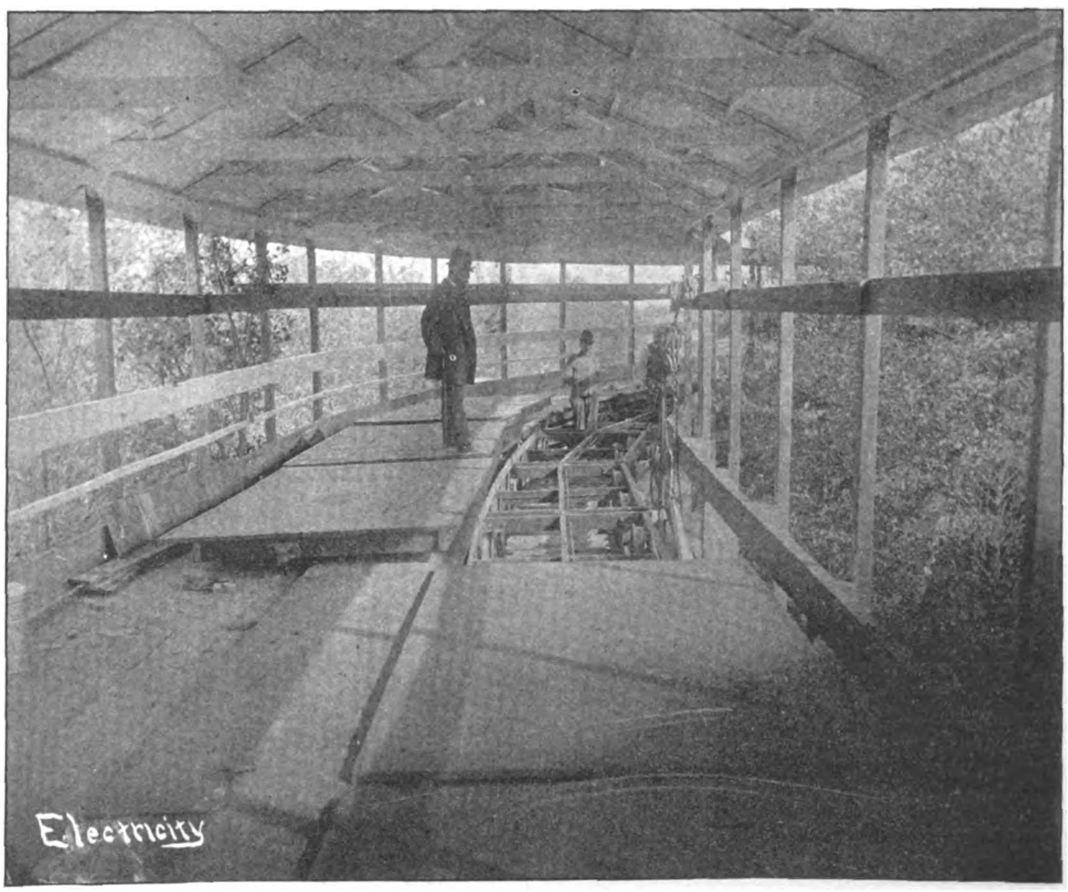
The movable sidewalk consists of a continuous row of overlapping platforms. Each platform is twelve feet long and rests on a separate car-truck. The trucks are coupled together by a short link. Fig. 2 shows the platforms without the seats, while in the background the platforms have been removed, showing the running gear and truck frames. The manner of operating can best be explained by referring to the cross sectional view, Fig. 3, which shows the supporting frame-work broken away.

The letters B and C indicate the two sidewalks, both of which move in the same direction, but the platform B moves twice as fast as the platform C. This is accomplished by supporting the outer platform, C, on the truck frame, H, and providing the platform, B, with a set of rails A', A, which rest on the wheels E, E', of each truck. It can readily be seen that if the truck and carriage move along they will carry the platform, B, with them, besides giving it a forward motion of its own; the result is that the platform B moves twice as fast as C. From the sidewalk, F, which is stationary, the passenger wishing to ride can step to the walk C, which will move at the rate of about two



Movable Sidewalk, Fig. 1.

or three miles an hour; he can then move faster if he wish to by stepping to the observation sidewalk, B. On this walk seats are provided. The



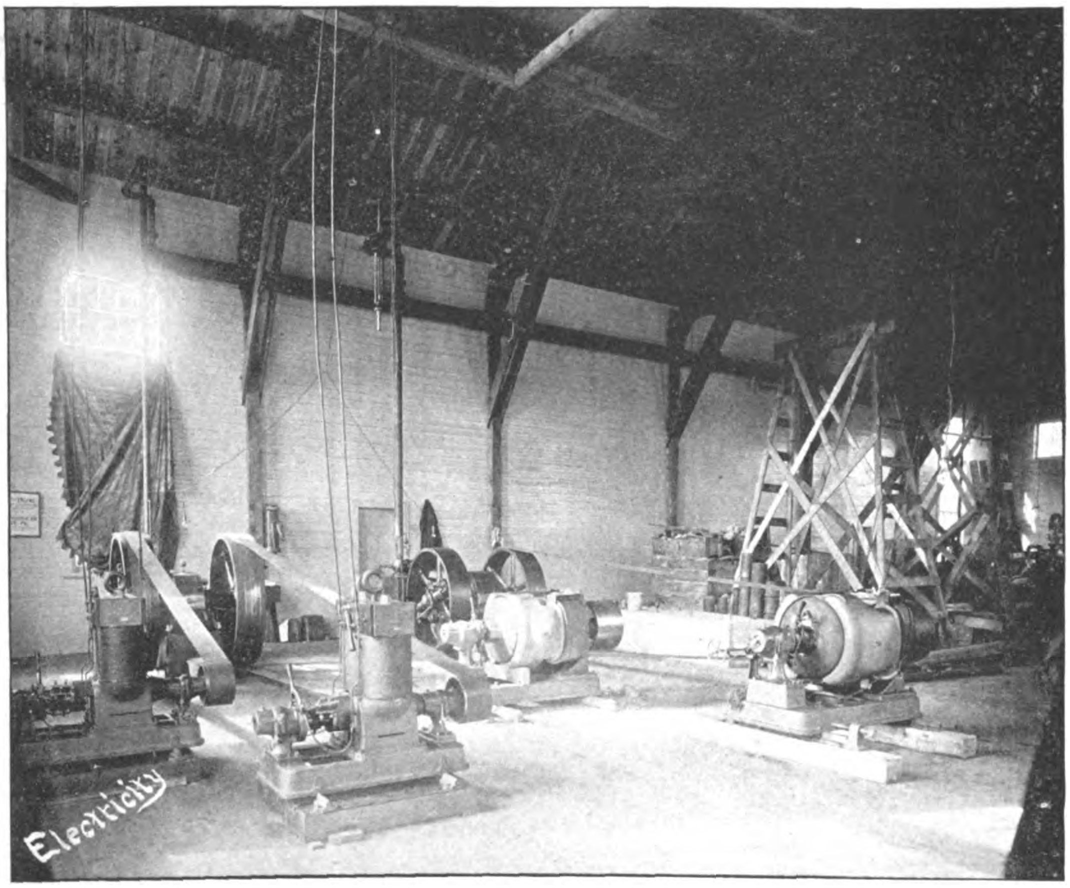
Movable Sidewalk, Fig. 2.

passengers can easily walk on either of the sidewalks while in motion.

Electricity is the propelling power in the experimental sidewalk, and will undoubtedly be applied to the one the company intend to encircle the grounds with. Three of the trucks have been equipped with two 15 h.p. motors similar to those in use on electric street cars. An important feature of the movable sidewalk (and one that will do away with the "deadly overhead trolley wire that is agitating the daily newspapers of the country, should this system of transportation be adopted on our streets) is the placing of the feeder wire beneath the platforms in such a manner

that all danger of accidental contact with it is avoided. Current is carried to the motors from this wire by means of a trolley wheel and pole attached to the lower side of the car frame as represented at D, Fig. 3. A return circuit is secured by connecting the steel rails together with bonds in the same manner as in street car track construction. Power is supplied from the power station seen on the right in Fig. 1. A 125 h.p. Ideal engine and a Thomson Houston 107 h.p. multipolar railway generator are installed in the power house.

The moving portion of the sidewalk will be under the control of one man in a controlling station built at one side of the track, and he will be in a position to overlook the whole of his train. Within easy reach he has a main switch, a reversing switch, and rheostats, all arranged so that they can readily be operated in case of accidents. As an extra precaution against a break-down in the machinery or an accident to anyone on the train of cars, a system of electrical signals has been arranged, push buttons being placed about sixty feet apart. These are connected by means of concealed wires with an electric bell and an automatic circuit breaker in the controlling station, by



Temporary Electric Light Plant at the World's Fair Grounds.

means of which the train can be instantly stopped by any one pressing the button.

It is estimated that at least 40,000 passengers can be handled every hour with the greatest comfort and safety. The fact that the sidewalk has a continuous motion is an important feature in comparing its speed of transporting passengers with that of the ordinary methods.

On account of the action of the authorities of the World's Fair in closing the grounds against visitors without passes, the company have decided to use the elevated sidewalk as a point from which the thousand of visitors that daily go to Jackson Park can view the work on the buildings as it progresses, by paying a small admission fee.

The patents which have been granted to Mr. Max E. Schmidt and J. L. Silsbee on the movable sidewalk, are owned and controlled by the Multiple Speed and Traction Company, of Chicago. Among the many places where the company claims that this system is applicable to the task of transporting large numbers of passengers from one point to another are the Brooklyn bridge and Broadway, New York. At present they are working on plans for furnishing a movable sidewalk of the above description for a tunnel 2,500 feet long in Port Elizabeth, South Africa.

REPORT OF THE COMMISSION ON SUBWAYS FOR WASHINGTON.

The report of the board, composed of Mr. Andrew Rosewater, Mr. Henry A. Rowland and First Lieut. Francis R. Shunk, Engineer Corps, appointed by President Harrison, under due authority of the District Appropriation Act, approved Aug. 6, 1890, to consider the location, arrangement and operation of electric wires in the District of Columbia, has just been placed in the hands of the President.

The result of the investigation and deliberations of this commission has been anxiously awaited by many, as it was thought that its official character would enable it to obtain fuller information on the subject it had to deal with than would be accessible to other investigators. It was thought that its decision would settle once for all the much mooted question "Is it practicable to bury the wires," and if so, "which of the many systems now in successful operation is the best?"

Imbued with this belief, several cities contemplating the construction of electrical subways have withheld action pending the report, an abstract of which is now before us. It is a very long document and we can only give a synopsis.

After having decided that the burial of the wires is entirely feasible and practicable, both from an electrical and business standpoint, the question of how they shall be buried is discussed. Three types of conduits are considered, viz.: The open conduit or tunnel; the solid conduit, in which the conductor once laid is permanently fixed in position by filling in the duct with insulating material, and the "drawing-in" system, which consists of tubes or ducts which permit the introduction and withdrawal of the conductors at will.

In regard to these questions the commission have come to the conclusion that the only plan of subway construction possessing the semblance of practicability for all the conditions to be met, is the last, or "drawing-in" system. As to the best form of duct, they have decided upon the vitrified clay, of the pattern known as the Lynch-Lake conduit, buried in cement. As to whether a single line of conduit shall be placed in the middle of each street, or two lines be constructed—one on either side—the latter plan is favored.

They announce themselves unequivocally in favor of municipal control, and justify this stand by the statement, which is not by any means generally accepted, that the municipal control of gas and waterworks in many cities of the country has proved beyond question the wisdom of such a course. They say that 43 per cent. of the waterworks of the country, and fully 75 per cent. of the investments in water works plants, are owned and controlled by municipal corporations, and that without exception such ownership has brought about a material improvement in the water supply and a reduction in the water rates.

They then draw up plans for a subway system for Washington. These provide conduits with a minimum capacity of four and a maximum of sixteen ducts.

Signalling and alarm stations, uniformly located as far as possible at the southeast corner of intersections within reasonable distances apart, are suggested, and ventilation is provided for by lamp-post connections.

The manholes are to be drained by valve sewer connections in the lower sections of the city liable to overflow or subject to backwater, and in the upper portion of the city by means of open trapped sewer connections. The manholes are to be lined with cement mortar or concrete, to render them impervious both to moisture and gas, and are to be covered with water-tight covers.

The following estimate of cost is furnished:

219,300	lineal	feet	or	41.54	miles	4	duct	conduit	$241,230
50,100	"	"	"	9.49	"	8	"	"	105,210
17,600	"	"	"	3.33	"	12	"	"	52,800
11,600	"	"	"	2.20	"	16	"	"	46,400
								Total	$445,640

298,600 lineal feet or 56.56 miles, allowing 10 per cent. for contingencies and supervision 44,564

$490,204

Total length of ducts 317.68 miles. Cost per mile $1,543.

The estimates contemplate manholes on an average of 300 feet apart. These are estimated to cost from $40 to $140 each, according to the size of the conduits terminating in them. The commission recommend that these ducts be rented out at a reasonable figure, and mention seven cents per lineal foot as being such a figure.

The report next takes up the electric railway system. This part of the report is certainly unique and, if not instructive, will be amusing to electric railway men. It recommends that these too be owned by the municipality, but provides that they be let out for terms of ten years to the highest responsible bidders upon a scale and schedule basis fixed by the city. The Commission object to the overhead system, first, because of the unsightliness and of the danger of the overhead wires, and second, because "a derangement in the conductor at one place affects all the cars in the system." They favor the storage battery system, but admit that there is an objection in the weight of the battery.

They think the conduit system the best, however, and the statement is made that experience has proved that the cable system is even more economical than the overhead electric system. Difficulties are admitted to exist in the conduit system as well as with the storage battery, and they say that all they can suggest on the subject of electric street railway regulation is that necessity being the mother of invention, the application of underground and other unobjectionable methods in the place of those now used will not materially advance until the municipalities exact either the underground wire or storage battery systems in the place of the overhead in the central and populous sections—either these or the cable system.

FROM NEWS CENTRES.

NEW YORK.

New York, Oct. 31.—If there is a distinguishing characteristic of electricians it is that they play with as much zest as they work. An exemplification of this was afforded on Thursday night, when the Electric Club was crowded with visitors to participate in the seductions of a "Wurzburger Nacht, or Relaxation Under a Pseudonym," as the invitation for the evening somewhat mysteriously put it. This turned out to be "beer and music," and constituted the second of a series of the season's smoking concerts of the club. The programme was almost entirely informal, the amateur talent being reinforced only by the excellent singing of the Gilbert Quartette, and the standard of the average performances showed that electricians are by no means one sided men. The success of these concerts cannot fail to be gratifying to the management of the club, which now has a membership of over four hundred and fifty.

The people of New York are grateful for small mercies and the whole town was glad to see the Broadway cars running on Tuesday morning along their legitimate route, after their compulsory dodging through unfamiliar side streets and back streets for the five months occupied by the laying down of the cable line. In the interim, it would seem that all the vehicles in town have learned to ply through the big thoroughfare and travel even on the cars seems slower and more interrupted than ever. The tearing up of the streets, however, has not been without its advantages. It is forty-nine years since the Croton water mains were laid on Broadway, and the earliest gas mains soon followed them. The Croton Water Department, which was blissfully ignorant of the condition of its pipes, has had the opportunity of thoroughly overhauling them. The state of the gas pipes on Broadway has for a long time been notorious, and the leakage of gas has been so great that it has been estimated that even if the surface of the street were laid bare, gas would continue to escape from the soil for years to come. Those who have had occasion to walk or ride down Broadway during the past few months, will not be disposed to question the truth of the estimate. The gas mains have now been repaired, and the public will doubtless reap the benefit, as less leakage will have to be charged for in their gas bills. The electrical, pneumatic and steam corporations have also availed themselves of the opportunity for inspection and repairs, and all those services have been improved. The erection of power houses and stations of the cable road is to be rapidly pushed on, and before many months the new line will be in working order. The cable is the next best thing to the horse, but it is hard to understand why the owners of the Broadway line did not save themselves $50,000 a mile by installing an electric system, while they were about it.

The Mayor and the Aldermen have signified their approval of the report of the Rapid Transit Commission. The next step in order is to obtain the consent of the majority in value of the property along the route of the proposed railways. About forty men will be employed in this work to start with, and that number will probably soon be increased, as there are about five thousand property owners along the lines. The aggregate assessed valuation of the property bounding on the proposed railway on Broadway, up to Fifty-ninth street (exclusive of property owned by the city), is, in round figures, $135,000,000. The assessed valuation of all the property bounding on the whole of the proposed lines, including the annexed district, amounts to hundreds of millions of dollars. The magnitude of the work of canvassing where such enormous interests are involved is apparent, but there is every appearance of a determination to accomplish the task with all possible speed. There is one detail in the proposed plan of construction of the road which is likely to secure the approval of the public. There is to be an entirely new sidewalk system, 18 to 20 feet in the clear, underground, throughout the entire length of Broadway, from the Battery to Central Park, on both sides of the way. This will be especially appreciated by Broadway merchants, for a customer anywhere along the line will be able to drop off at a station, and, without climbing a stairway, walk a short distance along a level sidewalk, sheltered from inclement weather, to the entrance of any store.

The arrangements for the electric illumination of the figure of Diana on the top of Madison Square Garden, have been completed this week, and the brilliant blaze of light can be seen for miles around the city. The beautiful tower which rises to a height of 341 feet, gives the best point of observation of any structure in the United States, excepting only that of the Washington Monument.

G. H. G.

BOSTON.

Boston, Oct. 31.—The selectmen of Melrose, Mass., have granted permission to the East Middlesex Horse Railroad Co. to build an electric railway through that town. The company proposes to run electric cars from Chelsea via Malden, Melrose and Stoneham to Woburn. Work on the equipment will begin very shortly.

The Trustees of Harvard College, being desirous of lighting their twenty-two acres of land and several of the buildings by electricity, have presented a petition to the Cambrige City Aldermen for authority to lay conduits under and across certain streets. The Cambrige Electric Light Company, however, opposed the petition, and it was defeated. The Electric Light Company claimed that to grant the petition would be to create a precedent that others might take advantage of in future, to the detriment of the local company's business.

The Thomson Scientific Club, of Lynn, has arranged for the delivery of a course of six illustrated lectures in Odd Fellow's Hall during November, December and January. Each lecture will be given by some eminent scientist. Professor Elihu Thomson will give the first lecture on Nov. 11.

It is reported that the Thomson Electric Welding Co. has just completed contracts with seven different companies for leases of its system on royalty. The parent company is busy in every department, experiencing difficulty in furnishing machines enough to supply the demand.

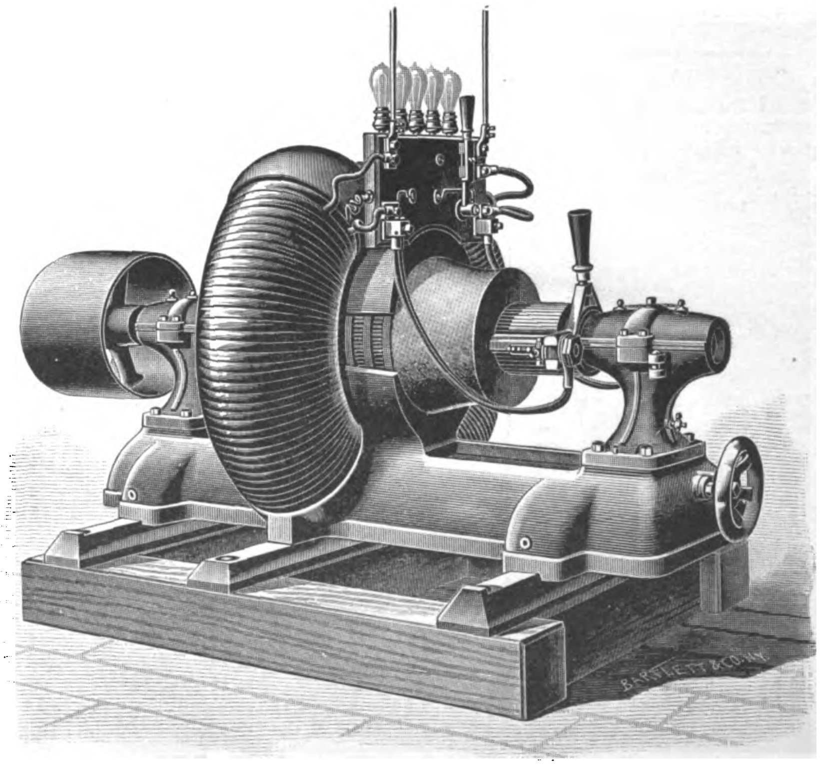
Work is being pushed in the construction of the Interstate Electric Street Railway, which is to connect Attleboro, North Attleboro, Pawtucket, Providence and East Providence, all points on the east side of Narragansett Bay, with the mill villages in the Blackstone valley as far north as Woonsocket, R. I. The track will be forty miles long when complete and the railway will serve an immense population.

Thursday last was an important day in the history of the Thomson-Houston Electric Co., for on that day the first English electric street railway using the overhead trolley system was opened in Leeds, the T.-H. Co. having equipped the road. There is every reason for believing that a big business is opening up in Great Britain, and the Thomson-Houston Co. is likely to get a large share of it.

W. S. K.

A NEW TYPE "C & C" DYNAMO.

The illustration on this page is taken from a photograph of a 50 h.p. "C & C" dynamo of a type recently placed on the market. The design is sim-



ilar to that of the well known circular field and consequent pole motor that is already familiar to the public. The machine shown in the illustration is wound for 500 volts and specially designed for power circuits. For a long transmission of power this machine can be specially wound to give automatic regulation under the greatest possible varying loads. A substantial terminal board carrying the field and armature connections, is bolted to the upper pole piece and is provided with a heavy knife switch for opening the main circuit. The mechanical construction is of the best throughout. The circular shape of the magnets gives them the greatest possible development of power for least weight, and every part is so constructed as to secure solidity and permanence.

The 100 h. p. dynamo made by this company is of exactly the same form as that illustrated and is especially suitable to be used as a power generator for street railway circuits.

These dynamos are wound in standard sizes, from 1 to 100 h.p., for electric lighting as well as for power transmission.

NUMERICAL ALPHABET.

This code is specially designed for abbreviating telegraphic messages containing large numbers. Any number containing not over six figures can be expressed in one word.

CONSONANTS.

B.	Represents	1	H.	Represents	6
C.	"	2	L.	"	7
D.	"	3	M.	"	8
F.	"	4	N.	"	9
G.	"	5	R.	"	0

VOWELS.

A.	Represents Units.	O.	Represents Thousands.
E.	Represents Tens.	U.	Represents Tens. of thosands.
I.	Represents Hundreds.	Y.	Represents Hundreds of Thousands

EXAMPLES.

One hundred and twenty-three .... BICEDA
1-2-3-

Two thousand three hundred and forty-five .... CODIFEGA
2-3-4-5-

Twenty-three thousand and four hundred and fifty-six ...... CUDOFIGEHA
2-3-4-5-6-

One hundred and forty-four thousand six hundred and twenty-nine......... BYFUFOHICENA
1-4-4-6-2-9-

This code is copyrighted by Mr. Herschel P. Copeland, of 133 South street, Jersey City, N. J.

The Calumet Street Railway Co., of South Chicago, are gradually extending their lines into the city. They have just placed an order with the Detroit Electrical Works for three additional 30 h.p. motors and one 100 h.p. generator.

NEW ELECTRIC LIGHT SUPPORT.

The device illustrated herewith has been designed to render incandescent lights adjustable to any desired position within certain limits, and is especially adapted for use in workshops and other places where it is desirable to bring the light in such position that it will illuminate the several sides of an object without having to move the object itself.

The device consists of an extensible lamp-supporting arm, hung by a ball and socket joint, from the ceiling, so that the lamp may be adjusted to and held in any desired position until forcibly moved to a new one.

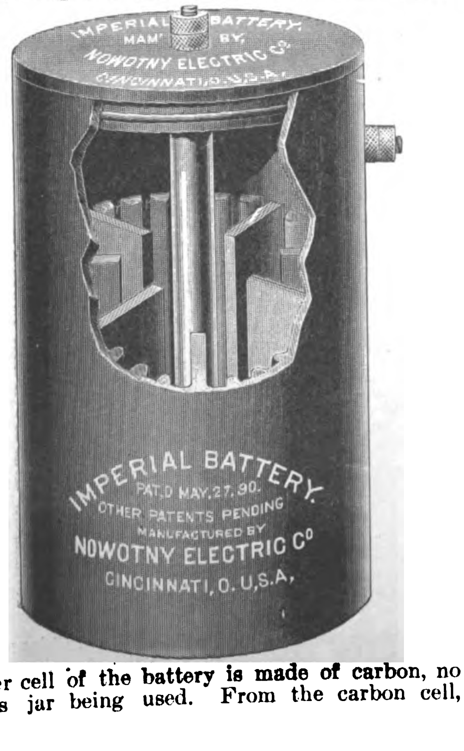
In the accompanying cut, A is a flanged metal rosette to be secured to the ceiling of a room, having a socket to receive a ball secured to one end of the rod B, and a set-screw for regulating the friction on the ball. The rod B carries the adjustable rod C, to which the lamp supporting and current conducting wire is secured by the screw eye and the string *h*.

The rod C has its bearings in the screw-eyes *c*, set in the sides of the rod B, and is pressed against the bearings, so as to create sufficient friction to hold it in any desired position by a spring interposed between the rods and adjusted by the set-screw *d*.

It is claimed that persons using electric lights in shops and factories will find the advantages of the lights very much increased by applying this supporting arm. It may be added that this device is equally well adapted for use on a wall bracket. It is manufactured by the old established gas and electric light fixture manufacturers, R. Hollings & Co., 547 Washington street, Boston.

THE "IMPERIAL" BATTERY.

This is a new form of open-circuit cell, of which the principal feature is the extremely large surface of negative element exposed. The entire



outer cell of the battery is made of carbon, no glass jar being used. From the carbon cell, which is corrugated on the inside, eight ribs of carbon project toward the centre completely surrounding the zinc. This arrangement gives a total surface of 196¼ square inches of negative element exposed to action below the level of the solution. The effect of this of course is to reduce the internal resistance and to minimize polarization by giving plenty of surface to collect the gas. No other open-circuit cell has more than 110 square inches of negative element exposed to action.

The "Imperial" is considered by its makers, the Nowotny Electric Co., of 30 East 5th St., Cincinnati, superior to anything heretofore put on the market; at any rate their aim has been to make it so, regardless of cost. It is somewhat more expensive than the average cell, but makes up for the extra price in extra quality. It is strong, durable and quick to recuperate after heavy work, and is intended for those who need a high-grade battery for continuous hard work.

A LARGE ELECTRIC LIGHTING CONTRACT.

One of the most important electric lighting contracts for an isolated plant that has been let this year in Chicago was closed this week between the Western Electric Co. and L. Z. Leiter, for furnishing dynamos and lamps for the new Leiter building that is to be occupied by the firm of Siegel, Cooper & Co., as a mammoth department store. The floor area to be lighted in the building is 596,696 square feet, or nearly 14 acres. This does not include the sidewalk, which borders three sides of the building, or the large alley at the back. The contract calls for six 50 light arc machines, two 1200 light incandescent, and one each of 600 and 400 light capacity, and 200 low tension arc lamps,

COMMERCIAL PARAGRAPHS.

The boiler department of the Pond Engineering Company reports increased activity, particularly in electric light and power work. Recent orders for steel boilers come from, Kansas City, two; Jefferson City two; Valparaiso, Ind, two; Waco, Texas, two; Laredo, Texas, second order; East St. Louis, Ill.; Waterloo, Ill.; Paducah, Ky.; Lawrence, Kan., and Arkadelphia, Ark.

The Electric Merchandise Company report shipments of Burton Electric Heaters during the past week to the following places: Salem, Ohio; Williamsport, Pa.; Toronto, Ontario, Canada; Oswego, N. Y.; Ottumwa, Iowa; Canton, Ohio: Akron, Ohio; Pottsville, Pa.; Troy, N. Y. Numerous orders, received from points widely separated, show that street railway men are alive to the advantages of electric heating for street cars.

The New Centre Vestibule top seat Pullman car has arrived safely at Boston, and will be exhibited and taken on a trial trip over the tracks of the West End Railway Company this week. Mr. C. L. Pullman, contracting agent of the Pullman Company, will be present at the trial, and he is confident that the result will be his closing a large contract for this novel style of street car.

The contracting department of the Pullman Company has just closed a contract with the City & Suburban Railway Company, of Portland, Ore., for 25 closed, double truck car bodies, for immediate delivery. These cars will be equipped with Thomson-Houston motors.

The Union Electric Manufacturing Company report a number of inquiries from all parts of the country in regard to their combination door-plate, push-button and annunciator, which was recently illustrated in Electricity. The company is expecting to place a novel wood box bell on the market in a short time.

H. T. Paiste & Co., of Philadelphia, announce their removal from 1206 Chestnut street, to number 10 South 18th street.

Clyde E. Coleman, till lately of the firm of Coleman & Freeman, has organized a new company and opened a general repair and experimental shop at 31 South Canal street. The company expect to manufacture a number of new inventions recently brought out by Mr. Coleman.

Cutter's globe holder is being used in quite a number of Thomson-Houston arc light plants, and is said to be an improvement over the tube generally used.

The Electric Gas Lighting Company, of Boston, received a few days ago a single order for 5,000 "Samson" batteries; such orders as these, added to orders for hundreds and fifties that are received almost daily, are making matters lively for this prosperous firm.

The Electrical Supply Company, of Chicago, have arranged a very attractive display in their show windows on the corner of Randolph street and Michigan avenue. It consists of a small motor, running miniature lathes, drill presses and other machines. The toy skeletons that are attending the machines, are made to keep up a lively motion by means of a novel electrical contrivance. The display attracts numerous transient customers and will undoubtedly more than repay the outlay on it.

We have received from the Bridgeport Brass Company, of Bridgeport, Conn., a useful little book of tables, containing a quantity of data relating to the mechanical properties of wire, overhead construction, etc. The stress tables are compiled from actual tests made by Mr. H. D. Stanley for the Bridgeport Brass Company, who will be pleased to send a copy of the book of tables to anyone sending his address.

The Globe Carbon Company announce the removal of their works to Ravenna, Ohio, where they have a factory equipped with the most approved appliances, enabling them to turn out 100,000 finished carbons a day.

PERSONAL NOTES.

Maj. C. A. Benton, manager of the railway department of the Detroit Electrical Works, was in Chicago last week for a short visit on his return from the Pittsburgh Convention. The genial Major found great difficulty in getting away from his many Chicago friends, but by dint of stern resolve he escaped and is now back at work.

Mr. M. J. Sullivan, who has had charge of the advertising department of the Edison General Electric Company, has tendered his resignation and is about to embark in journalism. Mr. Sullivan has made an excellent record in his previous work and will have the best wishes of a large circle of electrical friends for his future success.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCT. 13 and 20, 1891.

DYNAMOS AND MOTORS.

461,862. Electric Generator. Charles G. Young, New York. Application filed April 25, 1889.

461,979. Dynamo-Electric Machine or Motor. Max Mayer, New York Application filed May 5, 1891.

TELEGRAPH AND TELEPHONES.

461,887. Multiple System for Telephone-Exchanges. William E. McKivitt, St. Paul, Minn. Application filed Mar. 30, 1885.

LAMPS AND ACCESSORIES.

461,898. Incandescent Electric Lamp Socket. Cecil P. Poole, Lynchburgh, Va. Application filed Mar. 5, 1891.

462,053. Rheostat for Electric Lamps. Thomas A. Lacey, St. Paul, Minn. Application filed May 5, 1891.

BATTERIES.

461,823. Secondary Battery Electrode. Justus B. Entz, New York. Application filed Oct. 31, 1890.
A battery electrode made up of wire bent upon itself to form a mat or plate in combination with wire loops or straps surrounding the same,

461,858. Secondary Battery. Montgomery Waddell and Justus B. Entz, New York. Application filed Oct. 31, 1890.

461,965. Galvanic Battery. Calvin N. Souther, Chicago, Ill. Application filed Mar. 23, 1891.

RAILWAYS AND ACCESSORIES.

(Granted Oct. 27, 1891.)

461,808. Electric Car Brake. La Motte C. Atwood, St. Louis, Mo. Application filed Jan. 10, 1891.
The combination of brake-shoes and the motor, and an independent connection between the track-brake and the motor, whereby the brake-shoes alone can be applied or the brake-shoes and the track-brake both applied at will.

461,810. Signaling System. Frank P. Benjamin, New York. Application filed April 19, 1889.

461,840. Trolley for Electric Cars. Chas. A. Lieb, New York. Application filed Mar. 23, 1891.

461,851. System of Distribution for Electric Railways. Sidney H. Short, Cleveland, O. Application filed Jan. 4, 1890.

461,969. Electric Railway. William B. Vansize, Plainfield, N. J. Application filed Sept. 1, 1890.

461,014. Electric Railway. George W. McNear, Oakland, Cal. Application filed Oct. 11, 1889.

462,022. Electric Railway Switch. Hollow C. Spaulding, Boston, Mass. Application filed Sept. 26, 1890.

462,158. Underground System for Electric Railways. Samuel D. Nesmith, Cleveland, O. Application filed Aug. 4, 1890.

462,177. Electric Railway. Charles W. Thomas, New York. Application filed May 6, 1890.

462,219. Electric-Railway Trolley. Rudolph M. Hunter, Philadelphia, Pa. Application filed July 1, 1891.

MISCELLANEOUS.

461,814. Electric Heater. John V. Capek, New York. Application filed Oct. 30, 1890.

461,868. Electric Connection. James H. Fleming, Newark, N. J. Application filed Jan. 9, 1891.

461,991. Lightning Arrester. Edward Van Brunt and William M. Raynor, Scranton, Pa. Application filed May 16, 1891.

462,020. Automatic Regulator for Dynamo-Electric Machines. William L. Silvey, Lima, O. Application filed July 5, 1889.

462,033. Circuit Controller. William B. Cleveland, Cleveland, O. Application filed June 17, 1891.

ELECTRICITY.

VOL. I. CHICAGO. NOVEMBER 11 1891. NEW YORK. No. 17.

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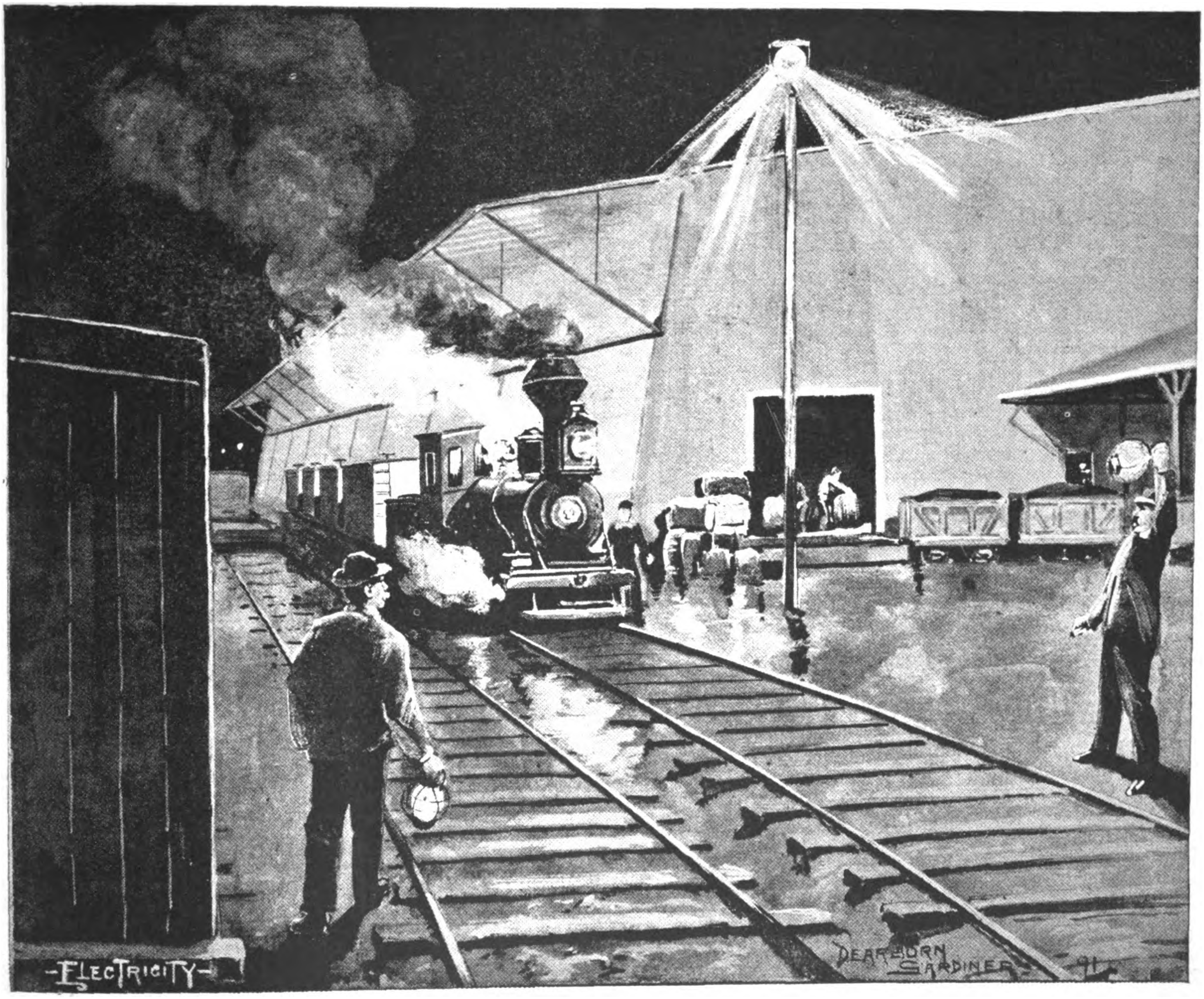
ELECTRICITY.

Vol. I. | Chicago. | NOVEMBER 11, 1891. | New York. | No. 17



THE ELECTRIC LIGHT IN A FREIGHT YARD.

(See page 216.)

RAILWAYS AND THE ELECTRIC LIGHT.

Railway men as a general rule do not take kindly to the applications of electricity and generally need very thorough conviction before they can be brought to believe that electricity can help them to any great extent in their work. The telegraph systems of our railroads are in a great many instances inefficient, undermanned, poorly equipped, and badly maintained. In electric signalling devices, most American railroads are behind the times, and electric motors are almost unknown.

But it is in the adoption of the electric light that railway managers are particularly deficient and behind the times, as in many departments of their work, the electric light can aid them enormously. As regards train-lighting, not much perhaps can be said, because for such work electricity is somewhat at a disadvantage in competition with gas on the score of economy, although in every other quality it is vastly superior. Granting, then, that electric train lighting is today somewhat of a luxury, this is by no means the case when we go out of doors, or even into the stations. In large stations the electric light can speak or rather shine, for itself, and gas should have no place; but in freight yards the electric light is a positive necessity, and gas has absolutely no chance at all. The accompanying drawing gives an idea of the excellent effect of the arc lamp properly arranged in a large freight yard; the artist has drawn but a corner of the yard, but still the clear, soft light, evenly diffused over a large space, by an arc lamp hung high up, is perfectly apparent.

The lighting of a large freight yard can be admirably effected by means of arc lamps placed at proper distances apart, and hung, say, not lower than sixty feet from the ground. The globes are ground on the lower half to diffuse the light. The result of this arrangement is an even steady light over the whole surface illuminated, a light something like very bright moonlight, which proves to be of excellent service in actual practice. There is nothing to dazzle the eyes of the trainmen and the work is performed with the greatest regularity. It is found that in freight yards lighted in this way, the business is improved in many respects. It is found that the work is performed more quickly and with greater certainty; there are fewer accidents because the men can see what they are about and can judge distances better. For the same reason there are fewer breakages of cars, involving less damage to rolling stock and freight. Last, but by no means of least importance from a financial point of view, the losses by theft are greatly decreased, because the cars can be more easily watched and inspected. It is calculated that the saving in this respect, pays for the equipment of the lighting plant in a very short time. An expert on the subject says very trenchantly; "If you once properly put electric lights in a freight yard, you will never take them out again; the trainmen would not stand it, as they would be in the dark in more senses than one if the lights were taken away."

A NEW STORAGE BATTERY CAR.

BY W. S. KEY.

Notwithstanding the report on electric traction submitted by Mr. G. W. Mansfield at the recent street railway convention, in which that gentleman made a somewhat surprising condemnation of storage batteries for traction purposes, and declared that he had "no faith in them and no hope for them," progress is being made in the direction of final success; and it goes without saying that many people are induced to echo Shakespeare's saying that it is "a consummation devoutly to be wished."

There are at the present time in England and America, more than one successful storage battery car system doing satisfactory work, and the most recent experiments have demonstrated that it is not unreasonable to look forward to a speedy solution of the problem as to the efficiency and economy of this method of street car propulsion.

In Sioux City, Ia., some highly satisfactory results have just been attained with a car equipped with a Steven's motor and Bradbury-Stone storage batteries. The car is equipped with two motors of seven and one-half h. p. capacity each, and these are supplied with current from 140 accumulator cells placed under the seats of the car. The road on which the trial trips were made is a singularly difficult one, having some very steep grades and several sharp curves.

Those interested in the undertaking, both from the East and belonging to Sioux City, were at first, somewhat doubtful as to whether the car could be made to overcome the difficulties of the road, but two of them, at least, had confidence. These were Mr. J. Y. Bradbury, inventor of the battery, and Mr. Knapp who represented the constructors of the motor. They undertook to demonstrate the practicability and efficiency of the system and accomplished all they undertook. After various trips on a level stretch where excellent results were obtained, tests were made in running up grades. Starting from the foot of one steep grade about 1,800 feet long, the distance was run in ninety seconds, or at the rate of a little over thirteen miles an hour, the full current being turned on without any damage whatever to the battery.

A severer test than this was next made. The car was taken down to the foot of a high bridge, an illustration of which accompanies this article, and started from that point. This run was 4,200 feet, up a very steep grade, and most of the distance around curves. This same run was made twice, once in five minutes and once in a few seconds longer time, being at the rate of ten miles an hour.

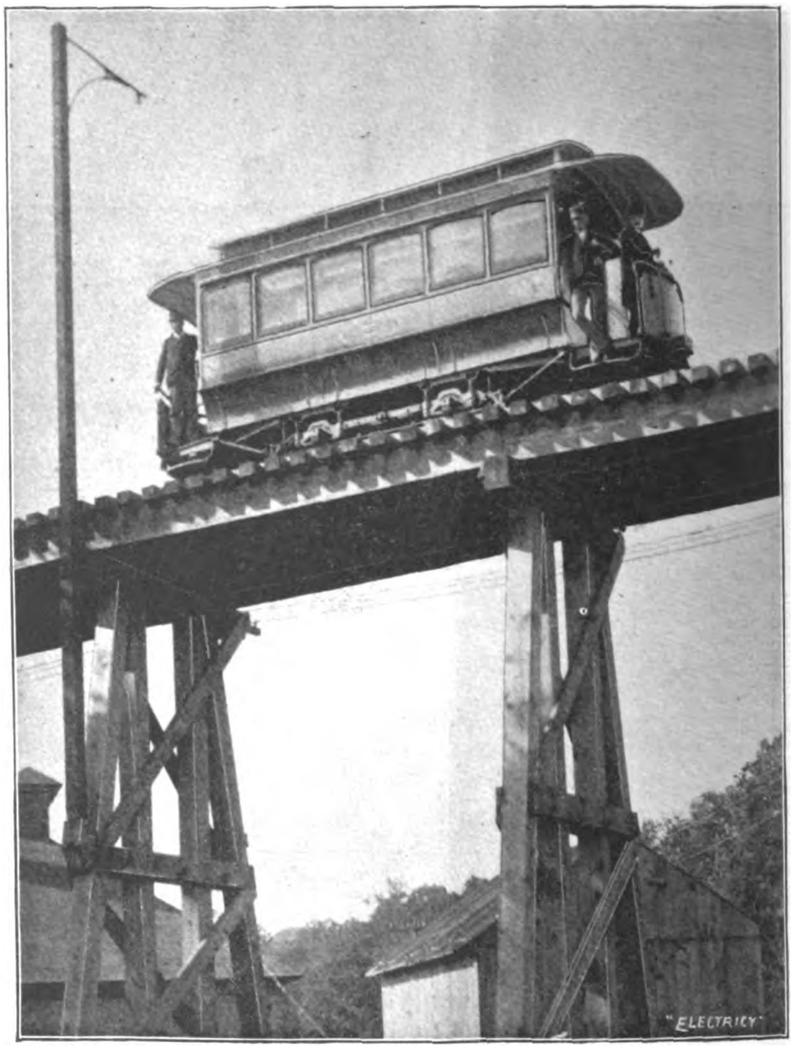
During these runs careful readings were taken every ten seconds which showed the following results:

The trip of 4,200 feet was made in 1⅔ minutes, or at the rate of 8.42 miles an hour, with an expenditure of 27.8 electrical horse power.

The trip of 1,500 feet was made in 5½ minutes, or at the rate of 11.4 miles an hour, with an expenditure of 26 electrical horse power.

The second trip of 4,200 feet was made in 9 minutes, or at the rate of 5.29 miles an hour, with an expenditure of 11.4 electrical horse power; during this trip the switch was only half open.

Subsequently several trips were made on the level, during which the speed attained was between 25 and 30 miles an hour. In ascending these grades; in fact on every trip, the car was



NEW STORAGE BATTERY CAR.

loaded with passengers. Several times the cars jumped the track owing to faulty construction, but by means of a short stiff plank or sleeper, the track was regained with ease and without any extraneous assistance.

On returning to the power house the car encountered two cars of coal with a total load of 25 tons at least. These had to be shifted out of the way and this was quickly done by the passenger car which pushed them both together up a steep grade at a brisk rate of speed.

When starting on the trips the current registered 315 volts, after running 26 miles the voltage had only dropped to 298, thus demonstrating the efficiency of the batteries.

It might be thought that the changing of so large a number of cells would take up much time, but the change is actually made in less than 2½ minutes.

Every one who witnessed these experiments

was more than satisfied with the results, and subsequently a company was organized with $1,000,000 capital to establish a factory in Sioux City, to meet the requirements of the western field, while the factory at Lowell is to continue supplying the east.

Incidentally it may be stated that the electric railway between Milford and Hopedale, Mass.; is a storage battery road and is doing a very lucrative business. Although it has been in operation now for nearly eight months, the cars have cost less than $100 in repairs.

CURRENT ELECTRICAL TOPICS.

The tendency in Europe seems to be for the State to acquire the telephone systems, For example, in Austria, negotiations have just been completed by which the systems of some eight towns of the Empire pass from private to government control. It is also reported that at the end of next year the Telephone Company of Austria will cease to exist as a private organization, and control of the business will pass entirely into the hands of the State.

* * *

According to a correspondent of the *Scotsman*, telephone service in Paisley is rendered for $25 per annum to a subscriber having an individual wire; where two people use the same wire the rate is $15 per annum apiece.

* * *

Somebody—a Mr. Shippey and an Englishman—has evolved the brilliant idea of utilizing the waste heat which is radiated from locomotives, by covering their entire surfaces with thermo-electric elements. The current thereby generated he proposes to employ to charge storage batteries on the train and these again to light the cars.

It is said that the Great Western Railway, of England, offered to let him apply his device to one of their locomotives, but as he was required to do it at his own expense he was obliged to abandon the plan.

* * *

During the Edinburgh (Scotland) Exhibition, 100,000 passengers were carried in electric launches along the canal from Edinburgh to the exhibition.

* * *

A telephone has now been permanently installed between one of the hotels in Paris and the Grand Opera, over which a person at the former can hear the opera being performed at the latter. The charge is ten cents for five minutes service, and although the novelty of hearing an opera by telephone makes it attractive, the service is said to be satisfactory and to possess merits of its own. But if one should happen to have the instrument during an intermission he has to pay for it at the same rate.

* * *

They are in a quandary at the Lisbon Opera House. The Portuguese Government, though never under any obligation to pay the lighting bills, has heretofore done so, but now declines to be further responsible for bills which amount to over $30,000 per annum. It is stated that the electric light is found too costly, while the laying of gas mains would not solve the difficulty, as it would involve considerable extra expenditure of hard cash.

* * *

A very interesting article on "Polyphased Alternate Currents," is now running in the *Electrical Review*, (London). The numbers that have thus far appeared are historic and exceedingly well written. The style is simple, easy and popular. No clue is given to their authorship further than the initials E. H.

REPORT OF MR. HORNSBY'S SPECIAL COMMISSION TO EUROPE.

HEADQUARTERS WORLD'S COLUMBIAN EXPOSITION,
CHICAGO, November 3rd, 1891.

HON. GEORGE R. DAVIS,
Director General, World's Columbian Expo'n,

Dear Sir: I have the honor to request my discharge as a commissioner to Europe in behalf of the Electrical Department of the World's Columbian Exposition; and in doing so beg leave to submit the following report of the work accomplished and the circumstances under which it was carried on.

Under the letter of instructions issued to me Sept. 16th, 1891, I was commanded to "at once proceed to Europe under the immediate orders of the Chief of the Electrical Department, and visit the Electrical Exposition at Frankfort." When the exposition was closed I was "to visit such other points in Europe as were deemed advisable by the Chief of the Department." I was instructed to secure photographs and drawings of such portions of the exhibit at Frankfort as were necessary to give a good idea of the exhibit and its installation.

More in detail, I was instructed by the Chief of the Department of Electricity to make personal visits to such electrical firms in Europe as were deemed by me of sufficient importance, and to discuss with them the work of the Department, with a view to ascertaining their intentions in the matter of exhibiting, to give them such information as they required to pass upon the matter, and to answer questions.

Under these instructions I left Chicago Sept. 17th, and travelling via New York, Havre and Paris arrived at Frankfort on the afternoon of September 28th.

The many directions covered by my observations at Frankfort, and the varied phases of work that necessarily enter into the preparations for and the carrying out of an exhibition on a large scale, must be my excuse for dividing my report of this exposition into four sub-divisions: financial, architectural, physical and scientific.

FINANCIAL.

The Exposition was organized and carried out under corporate authority, a president and board of directors, a technical engineer and staff, and an architect and staff. The financial requirements for the beginning were met by subscriptions to stock, by donations from government and other sources, by anticipatory sale of admission tickets and by the sale of privileges.

The cost of buildings erected for its purposes, the preliminary work of its designers, the preliminary plans and architectural designs up to the date of opening of the exposition, aggregated $253,925. The running expenses of the Exposition during its continuance, including the expenses of installation, fuel for the machinery, salaries of engineer, music, etc., aggregated $128,450, making a total cost for preparations and running expenses of $382,375. Against these expenses there were estimated resources from which to draw, aggregating precisely a similar amount of money, viz.: $382,375. These sources of income included $162,500 for admission tickets and privilege of carrying on a lottery, sale of space and power, restaurant and wine privileges, catalogue and guide book privileges, cigar and flower privileges, receipts on percentage plan from a theatre, long distance telephone with music, phonograph booth, electric race course, art collection, electric boats which plied upon the river Main as part of the marine exhibit, electric lighting supplied to exhibitors, and electric elevator plying in a high tower built for the purpose, a panorama with electric effects, a captive balloon, etc.

Before the opening of the exposition 1,200,000 tickets of admission were placed with German bankers at 12½ cents each.

Anticipating an average daily attendance of 10,000 people and a Sunday attendance of 40,000 (which figures were amply justified by the actual attendance) the management of the exposition sold privileges, admissions, etc., as follows:

Admission tickets	$150,000
Lottery tickets	12,500
Power for operating machinery	40,000
Restaurant privileges	10,750
Beer, wines, etc	13,750
Percentage due the exposition for the sale of electric novelties including domestic work on electric machines, etc	2,500
Income from a large theatre equipped with the most modern and complete electric lighting and ventilating apparatus and effects, 25 per cent. of the gross receipts up to $37,500 and 40 per cent. of all receipts above that amount; also 50 per cent. of receipts from all lectures given therein, making an estimated total income of	11,250
Long distance telephone privilege, transmitting by loud speaking apparatus an opera from the opera house of Munich	2,500
Graphophone, phonograph and grammophone, 50 per cent. net	2,500
The Irr garten or labyrinth and shooting gallery—33 per cent. to the exposition	1,700
Electric race course with electrically propelled "Merry-go-round"	5,000
Long distance loud speaking telephone, transmitting music from Weisbaden, the corporation paying for the music at Weisbaden and retaining all the receipts which amounted to	3,750
Electric boats, 50 per cent. of net receipts	1,250
The Otis Tower with electric elevator; the Otis company having erected the building, 50 meters high and retaining the first $3,750, the corporation thereafter receiving 25 per cent. (entrance fee 7½ cents) receipts to the exposition	500
A panorama with view of New York Harbor, lighted by electricity, the panorama company having erected the building (12½ cents entrance fee) the corporation received 25 per cent	3,750
A captive balloon	1,500
A model theatre erected by Siemens & Halske of Berlin, exposing a new system of stage and auditorium lighting effects—50 per cent. of net receipts the firm having erected the building (entrance fee 5 cents) receipts to exposition	500
A mining railway also constructed and operated by Siemens and Halske, 50 per cent. of receipts at 5 cents entrance fee	250

In addition to these resources, there were charges laid against exhibitors for exhibition space as follows:

In the main exposition hall, for each square meter of wall or floor space, $3.75.

For each square meter of space in what were known as "half finished buildings" (unornamental), $2.50.

Out of door space, upon which exhibitors could make arrangements for erecting their own buildings, 50 cents for each square meter.

Still in addition to these resources, charges were laid against exhibitors for power as follows:

1 to 50 horse power, $7.50 per horse power during the three months of the exposition.

50 to 100 horse power, $6.25 per h. p. during the exposition.

100 to 300 h. p., $5 per h. p. during the exposition.

Over 300 horse power, $3.75 per h. p. during the exposition.

Rebates of from 5 to 35 per cent. were made for the benefit of those who expended amounts varying from 2,000 to 25,000 marks.

Some of the figures as to the income of the exposition were estimates on the part of the exposition management, and actual figures were necessarily unobtainable until after settlement with the exposition management and the holders of these privileges. This settlement had not been made at the date of obtaining information, but in each case where estimates rather than actual figures are given they seemed justified in the eyes of the management by the popularity and patronage of the several attractions.

It was admitted by the management that some mistakes had been made in overtaxing some of these privileges and underestimating the importance of others; for instance, the privilege for the Irrgarten, an attraction not known in this country, was believed to have been too cheaply sold. This attraction consists of a series of labyrinthian passways through vines, hothouse plants and shrubbery, lighted by electric lights and having large mirrors opposing many of the aisles. The attraction consisted in the enjoyment of the masses incident to being lost in this labyrinth, unable to determine by the eye which were aisles and which were mirrors. The attraction was a most popular one, well patronized, and the privilege for a similar attraction, I understand, is to be asked for for the World's Columbian Exposition. All of these attractions were more or less popular, but to all of them was objection on the part of visitors that an entrance fee into the grounds ought to have carried with it entrance to all places within the grounds.

ARCHITECTURAL.

The exposition occupied a plat of ground 2,000 feet long, 300 feet wide at one end and 1,000 feet at the other, a total of 1,200,000 square feet of space, including unoccupied ground. The exposition was divided into ten sections, for each of which buildings were erected as follows:

Main Machinery Hall, costing $26,750, was 150 meters or about 500 feet long by 30 meters or 100 feet wide. This building was of wood with concrete flooring, wooden platforms where they were required by exhibitors, arched roof in rough wood without any decoration on the inside, but presenting a most attractive appearance under the liberal system of decorations maintained in all the buildings. In it were 78 exhibitors, occupying space averaging 20 feet square (400 square feet) each. There was one main aisle running the length of the building, 15 feet wide, excepting at two points, where exhibits crowded into the aisle and changed its direction.

The next building in importance was the boiler house, adjacent to the main Machinery Hall, running parallel along its length 400 feet and 50 feet

wide. This building was erected at a cost of $6,250, was of brick and frame with concrete foundation, and contained 25 exhibitors, most of whom had machinery in operation for the service of the exposition.

The building allotted to exhibits of telegraph and telephone apparatus was the next in size, and was 250 feet long, 50 feet wide, of frame, ornamented on the outside with small towers and arched entrances. Cost, $8,750, including the cost of an annex half the size of the main building, devoted to an exhibition of electrical railway systems and electric signaling apparatus.

The next building was that devoted to the exploitation of various electric conduit systems, insulated wires, underground and submarine cables, and the material incident to the transmission of the electric current. This building, 200 feet long and 100 feet wide, cost $4,500. It was of wood, was floored with cement concrete, and contained 25 exhibition spaces. There were two main aisles running the length of the building, parallel and equi-distant from each other, and each ten feet wide.

A hall for general installation work was built on the lines of these other buildings, and at a cost of $7,500, a hall for electro-chemical apparatus costing $2,300, and a hall for chemical and scientific apparatus costing $3,825, completed the system of the main buildings for the use of the exposition. All of these buildings were of wood, possessing general ornamental features in finish, and wherever it was intended to plant machinery for operation the floorings were of cement concrete, and all wells for fly wheels were of the same material; all the concrete was independent of the walls of the buildings.

Looking toward Machinery Hall from the main entrance of the exposition were fountains, plats of flowers and grass and an ornamental music pavilion, from which music was dispensed afternoons and evenings by the famous Uhlan band of sixty pieces.

At one end of the grounds was an artificial knoll or hill with waterfall and caves lighted by electricity, the latter occupied by figures of gigantic monsters, dragons, etc., which breathed out electrically colored steam and spouted forth electrically colored water. A small lake into which this waterfall poured its contents was laid out with pleasing landscape effects, little islands, floral ornamentation and statues of nymphs.

The marine exhibit, containing the best and most modern apparatus for navigation and war, was situated on the River Main, some 500 feet from the main exposition. On the river, as a part of the exposition, plied aluminum and electric boats, as well as those operated by gas and naphtha motors. At the top of a tower, also on the river, were two of the now famous ground glass parabolic reflectors two meters in diameter, of immense lighting capacity.

Several large firms, requiring special facilities for making an exhibit, were accorded the privilege by the Exposition Company of erecting at their own expense buildings suitable for installing their exhibits. These buildings were made after designs approved by the exposition, located with a view to harmony, were ornamental in character, and added to rather than detracted from the general landscape and architectural effect of the whole.

PHYSICAL.

Under this head I wish to treat of the installation of exhibits and of the plant necessary for the operation of the exposition, which was also catalogued as a part of the exhibition, classified for competition, and subject to awards for excellence at the hands of the awarding jury.

The Service Plant. Beginning at the boiler house, power and light were supplied after the following scheme; manufacturers of boilers wishing to place their machinery in competition were charged for the space it occupied under the regular schedule rates, and they installed the machinery, laid the foundation, etc., at their own expense. The Exposition Company furnished the fuel employed, but exhibitors maintained and operated their own machinery. The wiring used for the service of the exposition was obtained by rental, the exposition paying for the three months use thereof five per cent. of the selling price, the owner to reclaim it at the close of the exposition. The boiler house being adjacent to the main machinery hall in which were the engines and electric generators, expense for connecting was borne jointly by the boiler and engine exhibitors. Exhibitors of engines were charged for the space which their engines occupied in the main machinery hall; each exhibitor installed his engines at his own expense, and paid to the Exposition Company an agreed amount for the steam necessary to operate the engines. Belting and the incidental apparatus for operating the generators from the engines, were paid for by the exhibitors of dynamos and these in their turn were charged for the space occupied by their generators and their electric apparatus, and the Exposition Company derived an additional revenue by charging the dynamo exhibitors for the power from the engines which was necessary for the operation of their machinery. The Exposition Company did the work of wiring necessary for the various department buildings and charged against each exhibitor in these buildings an amount necessary to cover the cost of the light furnished to each.

By this system of able financiering the Exposition Company, sharing only in the expense to the extent of the wiring and the fuel, obtained revenue first from the steam which came from the boilers, second, the power from the engines which were operated from this paid for steam, and third, for light furnished to individual exhibitors.

Lamps, incandescent and arc, were furnished free of cost to the Exposition Company in all the buildings and about the grounds by those exhibitors making displays of this class of apparatus. Of course those exhibitors operating dynamos to supply current, had the privilege of lighting space in which other of their own apparatus was on exhibition.

While the financial engineering, incident to this part of the work reflects great credit on the management of the exposition, a repetition of the system would hardly be possible either in Frankfort or elsewhere. There seemed to have been a misunderstanding between exhibitors and the corporation as to the expenses incident to exhibition, until exhibitors had progressed so far in their arrangements that it became impossible for them to decline exhibiting, therefore items of expense were borne which would not be tolerated on a second occasion.

INSTALLATION OF EXHIBITS.

As has been before stated in this report, exhibits were divided into sections according to their affinity and were placed in ten or more buildings. The large firms making general exhibits therefore, were compelled to prepare, install, maintain and pay space and lighting charges at several points. In two instances at least, corporations operated and maintained twelve exhibits each, in separate buildings or out of doors remote from the other locations of exhibits of the same firm. However much they might have desired to do so, the management of the exposition, carrying out its policy of sectionalizing exhibits according to their relationship to each other, would have found it impossible to save exhibitors the expense incident to the maintenance of these separate exhibits. Some of those in attendance upon the exposition and at least a few of the directors of the corporation, maintained the position that the existence of several exhibits of one firm at different points in the grounds or buildings, was an advantageous condition to exhibitors, because the tendency on the part of visitors would be to magnify the exhibitor's importance on account of his presence at so many points. The exhibitors on the other hand, contended that the added expense incident to this separation of exhibits, was not justified by the impression made on the minds of visitors; and contended further that the installation and maintenance of exhibits at so many points was too expensive to allow of that amount of decoration and the preparation of those features necessary to attract visitors. At least exhibitors were unanimous in the contention that the system was not one calculated to serve their best interests and I would respectfully present this feature of my observation to the consideration of the management of the World's Columbian Exposition.

No stringent rules were forced upon exhibitors for the installation of exhibits, and almost absolute freedom was allowed in their arrangement. The result was a most harmonious preparation of individual exhibits in the main buildings of the exposition, but a lack of symmetry and harmony in the effect of the whole.

Elaborate ornamentation and spectacular arrangement of exhibits are features developed by the European exhibitor to a point unknown in this country. European electricians and European electrical manufacturing companies are far in advance of those in the United States in artistic lighting and in the electric installation of dwellings, hotels and theatres. The designers of electroliers and metal ornamental work, spend much energy and great genius in these directions and the result in an installation of exhibits such as that at Frankfort, can hardly be exaggerated in description. Where usually there are iron railings with inexpensive and inconsiderable ornamentation, the exhibition spaces at Frankfort were enclosed by beautiful metal wreaths many tinted and exquisitely wrought, with here and there flowers of almost perfect design, inclosing within their petals tiny incandescent lamps, the globes tinted to reflect the shades of the flower intended to be presented. Wreaths in bronze, nickel and aluminum, were twined around metal trunks of trees as the corner posts of exhibits, and arches and canopies in vines of the same description, separated parts of exhibits, as it were by drapery, and secured for the exhibitor most beautiful effects.

Many of the signs intended to identify exhibition spaces were highly ornamental and of most attractive design. On occasions these signs proceeded to the extent of making object lessons in electrical science, and some again were carried in the direction of picturing scientific legends. The genius displayed upon these made bold contrast against the plain, unornamental signs which some exhibitors were unfortunate enough to display. Until the conditions along this line could be seen their effects would be impossible of imagination, and the enhancement of an exhibit by the display of catchy ornamental signs cannot be overestimated.

As has been said before, there were concrete floorings wherever it was intended to operate machinery, and on these, exhibitors having lighter machinery to exhibit prepared their space by erecting platforms suitable for the purpose, and though there were rules set specifically for the direction of exhibitors in the matter of the dimensions of these platforms, there was a general harmony created by a unanimous disposition on the part of exhibitors to act co-ordinately with each other, and with the management of the exposition. A few exceptions to this rule made possible an unharmonious effect that carried with it a strong lesson for the future.

In the case of heavy machinery, where preparations were necessary for the planting of driving wheels, etc. these preparations were made by going below the grade to a sufficient depth to allow of moulded trenches in the concrete of proper dimensions.

SCIENTIFIC.

Europeans very justly pride themselves upon their achievements in the scientific field of electricity, and have been materially aided in their laborious work by government support, especially in the educational institutions.

There were evidences of great progress in electrical work at Frankfort, especially in the direction of the generation and control of the electric current. Many complications in the constitution of electric generators have been discarded in exhibition machinery, new systems of transformers of the electric current from high to low potential were on exhibition, and new devices for long distance transmission of the current were for the first time placed in operation. I refer more particularly here to the experiments made in electric transmission of power from Lauffen, on the River Neckar, to the exposition grounds, a distance of 120 miles. In their experiments, the scientific gentlemen undertook to convey 300 horse power of current over this distance from a turbine operating in the River Neckar, over a new three wire alternating circuit at 25,000 volts pressure.

By a double system of transformers at Lauffen and at the exposition grounds, it was intended to reduce the pressure to 110 volts at the latter place, and to operate a circuit of incandescent lamps and motors. The experiment was an expensive one and the cost was met by a subscription, and by the liberality and confidence of the two companies which undertook it, by the donation of ten thousand marks from the Emperor, and by a like donation from the Exposition Company. The 360 miles of copper wire were lent gratuitously by F. A. Hesse & Co., of Heddernheim. The Allgemeine Electricitats Gesellschaft of Berlin, and the Oerlikon Co., of Zurich, made the experiment under the direction of Prof. Michael von Doliva-Dobrowolsky.

The current was transmitted as intended and the lighting of incandescent lamps was done, and to that extent the experiment was a success. Good authorities deny however, that more than 13,000 volts pressure were attained, and I believe the projectors will not claim to have saved for final application more than 60 per cent. of the original power, the loss being approximately 20 per cent in the dynamos and transformers and the other 20 per cent. in transit. No really satisfactory tests of measurement were made. For all practical purposes however, the experiments were essentially successful in that the principles set forth were demonstrated.

Lighting of art galleries by the use of arc lamps, was a feature that attracted much attention, and was brought to a state of perfection not hitherto achieved. The exhibitors were S. Elster & Co., of Berlin, and their process of lighting consisted in the total shading of pictures from the rays of

light by the use of yellowish-tinted ground glass laminated reflectors. Large cambric screens behind the lamps to throw the light upon the walls completed the system, which was uniquely simple, and more nearly resembled the light of day than any other system which the visitors had ever seen.

Another achievement peculiar to Europeans, was the exhibition of electric search lights and reflectors, especially the immense ground glass parabolic mirrors, 80 inches in diameter, which, with an arc light requiring 10 h.p. to maintain, cast shadows at a distance of 45 miles.

Still another noteworthy feature, and one in which Europeans far surpass Americans, was in the direction of stage lighting for theatres, and electric ventilators. Two theatres were on the exhibition grounds, one in miniature, in which were installed two distinct systems of theatre lighting, both deserving more than passing praise. By one of these systems the lights and shades incident to each of the twenty-four hours of the day, with all of the beautiful tints of dawn and twilight, the noon-day sun and the midnight moon, were marvelously portrayed.

These and other features of electrical progress were visible at the Frankfort Exposition, to indicate the untiring zeal, energy and intelligence with which Europeans are pursuing the star of progress, and though in the practical application of electricity, this country is far in advance of Europe, this is no reflection upon the state of the science in the other hemisphere but indicates rather the generally progressive characteristics of the American people, who appreciate to the extent of their application, the new things which their scientific men design for their comfort, convenience and enjoyment.

While it is of course impossible to go closely into detail in a report of this character, yet I would respectfully submit that during my stay in Frankfort I took occasion to make careful notes accurately in detail of the installation at the Frankfort Exposition, and these I feel will be of infinite benefit in the installation of the electrical exhibit for the World's Columbian Exposition.

EUROPEAN EXHIBITORS.

Taking advantage of the presence in Frankfort of the heads of representatives of more than 500 European electrical firms, I discussed with these, except in a few instances, the work contemplated for this department of the World's Columbian Exposition, and had expressions from them with regard to their participation. I would say at this point, that there are only a few, possibly a dozen, electrical firms in Europe which do a general manufacturing business The vast majority of electrical firms are engaged in manufacturing electrical specialties. In discussing matters with the firms doing a general business I found objections on their part to exhibit at Chicago on the score of the reputed superiority of American electrical machinery, and the alleged inability of Europeans to compete along these lines. There are a few firms however, so powerful in their own countries and so thorough in their methods, that they feel themselves competent to compete for business in any field. These few firms, to the number of possibly three in Germany, two in Austria, one in Switzerland, two in Belgium, four in France, and four in England, will participate in the World's Columbian Exposition in general competition and will make general exhibits. Exclusive of the above mentioned companies nearly all the electrical firms of Europe are engaged in specialty work.

These specialties they have developed to such a perfect state that in spite of all extraneous hindrances, they are able to do business not only in this country but throughout the world.

Barring unforeseen interferences, I have the satisfaction to state that a large number of electrical concerns in Europe will participate in the exhibition of this department of the World's Columbian Exposition.

For obvious reasons I shall not digress to the extent of discussing the intention of individual firms in respect of their participation at the World's Columbian Exposition, and will only say that the smaller firms--manufacturers of electrical specialties--admit that should the larger firms exhibit at Chicago, they, with their specialties, will be under compulsion to do the same, and to the end of securing this general result I am able to state that the following general electrical manufacturing companies of Europe will make complete and interesting exhibits at the World's Columbian Exposition:

Germany — Siemens & Halske, of Berlin; Schuckert & Co., of Nuremberg; W. Lahmeyer & Co., of Frankfort; O. L. Kummer & Co., of Dresden; Helios Co., of Cologne; Maschinenbau-Actien-Gesellschaft, of Nuremberg; Allgemeine Electricitats Gesellschaft, of Berlin.

England—Siemens Bros., of London; Crompton & Co., of London; Mather & Platt, of Manchester; Woodhouse & Rawson, of London, and, conditionally, a few others.

Switzerland—Oerlikon Manufacturing Co., of Zurich; Alioth & Co., of Basle.

Belgium—Societe Electrique, of Brussels; Societe La Phenix, of Ghent.

Austria—Ganz & Co., of Buda-Pesth.

France—Victor Popp & Co., of Paris; Sautter, Harle & Co., of Paris; Carpentier & Co., of Paris; Breguet & Co., of Paris.

In order to complete the business upon which I was ordered to Europe, I visited in addition to Frankfort, the cities of Nuremberg, Cologne, Berlin, Paris and London. Besides a large number of questions which I was able to answer to the electrical people whom I saw, questions were asked me as follows, some of which, being matters of corporation policy, I declined to answer at the time:

"Will European firms be given an opportunity to participate in the electrical service of the exposition—this service meaning the lighting and power station work, electric water craft, intermural railway, installation of lighting system for theatre, lighting of the harbor by search lights and reflectors, etc.?"

"Will the alien labor law of the United States admit the employes of European exhibitors who are necessary to the installation and maintenance of exhibits?"

"Will there be a ruling at the hands of the United States government which will guarantee the integrity of foreign patents?"

"Will the exposition corporation undertake to secure an established freight rate on steamship lines for foreign exhibits in addition to a distinct railway rate?"

"Will European exhibitors who desire to participate in central station work be allowed to choose engine and boiler machinery, and will the machinery so chosen be arranged for by the Exposition Company—that is, will the Exposition Company undertake to secure the presence of such engine and boiler machinery by paying freight charges for the same in consideration of its free use during the exposition?"

"Will arrangements be made by the Exposition Company for the care, board, etc., of the employes of exhibitors, at a fixed rate, on the exposition grounds or in the vicinity, or must exhibitors make individual arrangements in this behalf?"

I was informed by at least two exhibitors that machinery weighing 45,000 pounds to the single piece would be part of their exhibits and the question was asked whether this machinery could be moved; the answer which I gave, viz: that arrangements would be made for moving pieces of 30,000 pounds, was met by the supplementary question "How can heavier machinery be moved by exhibitors and what will be the cost?"

I am anxious to be able to answer all these questions to the end that they may prepare at once for the perfection of their exhibits along the lines to be established.

Before closing this report, I beg leave to state that in all cases where commissioners have been appointed by foreign governments I discussed my work with these commissioners or their representatives before dealing at all with exhibitors, and dealt wholly with these last upon lines distinctly agreed upon with the government commissioners. Herr Wermuth, Chairman of the German Commission, had not returned to Germany from Chicago when I left there, but in conference with his able representative, Privy Councillor Herr Caspar, a mutual course of action on the part of this department and the commission was agreed upon, touching the basis of dealing with exhibitors, and in London in conference with Sir Henry Wood and Mr. W. H. Preece, of the Royal Commission, similar agreements were had, fixing a policy which should be the basis of our intercourse hereafter. Under these agreements all pamphlets or circulars or items of information to be transmitted to exhibitors, may be transmitted directly to the exhibitors, but a copy is to be sent to the Royal Commission with the names of the firms or individuals to whom sent; in all cases a paster to be attached to documents pointing out to exhibitors that all business between them and the World's Columbian Exposition must be done through their government commissions.

I wish to report briefly that in Paris I found a peculiarly unfortunate condition. There is a commission for France, made up of some of the best men in the Republic, but the appointments to the commission were understood to be honorary, and no work has yet been done. I learned from the Hon. Whitelaw Reid, United States Minister to France, that upon the opening of the Chamber of Deputies this winter, a bill will be introduced by the Premier for an appropriation with which to carry on World's Fair work, and that after the passage of this bill, a working commission will be appointed, which in turn will appoint sub-commissions for the various departments. In the meantime however, much trustworthy information is being circulated, and the French people, especially the business men and manufacturers, are eager for authoritative data. Failing to obtain this information, they are disposed to a lethargic attitude. Advice was freely given me by Frenchmen enthusiastic in behalf of the exposition, that a commission from the exposition ought to be constantly present in Paris, at least until a government commission was placed in charge of the work.

MAGNETIC RELUCTANCE.

Mr. A. E. Kennelly read a paper on the above subject before the American Institute of Electrical Engineers, on Oct. 27. Whenever Mr. Kennelly writes we expect to be instructed and this instance is no exception to the rule. The paper is well worthy of reproduction, but it is so severely technical as to be scarcely suitable to this paper. The use of curves representing the relation between two variables has proved of such value in scientific discussions that they are now considered almost indispensable to the handling of such subjects, and in none less so than in magnetism.

Heretofore, curves showing the relations between magnetising force and flux density, magnetising force and permeability and between flux density and permeability have been freely and instructively used. Mr. Kennelly now adds a fourth curve derived from the variables reluctance and magnetising force, which graphically explains some phenomena either not shown or but obscurely so in the other curves. This new curve commences high up in the direction of the ordinates which represent reluctances, and descends sharply in an apparently straight line to a point of low reluctance and magnetising force, and then with a sharp curve ascends again in nearly a straight line at a considerable angle with the axis of abscissae. This is in exact accordance with Ewing's experiments with systems of small magnetic needles and shows by its sharp bend that a critical point is reached in any system of elementary magnets when, being in unstable equilibrium, a very slight change of magnetising force causes them to break away from their mutual attraction and to conform more readily to extraneous magnetising forces. The same thing is shown in the curve connecting magnetising force and flux density, but Mr. Kennelly's curve makes this action much more apparent, and presents it in a form that admits of much more careful study. Nor is this all. Where empiricism is the rule, as was the case with magnetism until recently, the formulæ employed, if formulæ there be, are the result entirely of tentative work. Some of these are found in practice to give more or less accurate results but the why and wherefore are usually unknown. Such a formula was Frolich's. Its application was admitted, but for a long time not understood. Sylvanus Thompson was the first to interpret it in words, but no light had been thrown upon it by any of the curves heretofore in use. Mr. Kennelly's curve, however, does throw some light upon it and Frolich's formula can no longer be regarded as empirical but rather as representing a definite law. Mr. Kennelly illustrates his paper with a number of curves derived from the investigation of the magnetic properties of various samples of iron, nickel and cobalt made by Ewing, Low, Rowland and himself, which will be exceedingly interesting to those delving deeply into the phenomena of magnetism.

An important sale of the West Side street railway of Milwaukee is announced. This purchase, by the Villard syndicate, gives them the entire control of the street-car system of Milwaukee and adds to their already large purchases one of the most profitable lines in the city. The transfer of this property will end the litigation that has been carried on in the state court for nearly two years between the two competitors, for numerous franchises.

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Storage Battery Traction. Our correspondent, Mr. W. S. Key, gives an interesting account of some trial trips on a new storage battery road at Sioux City, Ia., which goes far to refute the sweeping denunciation of the storage battery system uttered by Mr. G. W. Mansfield, at the Pittsburgh Street Railway convention. The results are not conclusive, however, since the grades were not large, and it is the mounting of grades that is most trying to the storage battery, and the lack of ability to do so without injury to the cells that lays the storage battery most open to criticism. The severest grade which the car in question was called upon to surmount was one of 4,200 feet, averaging about four per cent. This, to be sure, is a severe test for a storage battery; but nothing compared with what the trolley cars are continually being called upon to do. The real test cannot be made by a single trip, but will be the length of life which the batteries will show when continually mounting this grade.

* * *

The World's Fair and the Frankfort Exposition. Mr. Hornby's report furnishes some data that enable us for the first time to accurately draw comparisons between the magnitudes of the late Frankfort Exposition and the World's Fair to be held in Chicago, in 1893. The Frankfort Exposition occupied a plat of ground covering a total of 1,200,000 square feet, including unoccupied ground. A single building, at Chicago that of Manufactures and Liberal Arts, will cover a ground space of 1,330,144 square feet, thus exceeding in area the whole of the Frankfort Exposition grounds by 130,144 square feet. A few of the principal buildings, including the Fisheries, U. S. Government, Manufactures and Liberal Arts, Administration, Agricultural, Machinery, Mines, Electricity, Transportation, Horticultural and Women's, cover a ground space exceeding 3,700,000 square feet, or considerably more than three times the area of the Frankfort Exposition grounds entire. A single comparison of the amounts expended on buildings will also be interesting. The Machinery Hall at Frankfort with power house cost $32,950. The same at Chicago will cost $1,200,000.

* * *

The World's Electrical Congress. Mr. Hornsby's special report on his conferences with notable electrical men in Europe, shows that great interest is already felt abroad in the proposed Congress. This report, which will be found in this issue, is published at a very opportune moment when the formulation of a programme for the Congress is about to be discussed in earnest. Mr. Hornsby sets forth very clearly the views expressed by several famous European electricians on the shortcomings of past electrical congresses and what they hope to see accomplished and think ought to be accomplished by the Congress of 1893. There can be little doubt that the purely scientific work of the congress will be its most useful and valuable feature. There are various important questions to be settled. The suggestion that the invitations be sponsored by the United States Government and addressed to the delegates through the governments of the various countries to which they belong, is undoubtedly a good one. This method of procedure will not only give the Congress a truly international stamp by binding all those countries which shall take part in it to abide by the decisions arrived at, but will remove any possible cause for dissension among electricians at home, as to the question under whose auspices the Congress shall be held.

* * *

American Electrical Units. In an editorial which appeared on August 26th, in commenting upon the proposed Electrical Congress at the World's Fair, we said "it might and ought to result in honoring some of our early investigators by perpetuating their names in the nomenclature of the science to which they have contributed so much. But the steps necessary to this accomplishment should be taken at once, so that the foreign societies, as well as those of our own country, may have time to formulate their views as to what questions should and should not be discussed, as to what changes, if any, are necessary or desirable in the present nomenclature of electricity, and as to what new units are in demand, and as to what they shall be." We also insisted that the invitations to the Congress should be extended by the proper authorities to give them the necessary dignity, and we did not think the officers of the World's Fair were the proper authorities.

The position then taken by ELECTRICITY, and we stood alone, has been not only endorsed but insisted on by the scientists abroad whom Mr. Hornsby consulted on the subject.

Mr. Hornsby states that it is admitted abroad that while Americans have done at least their part for humanity in the sciences, there are no recognized units credited to Americans, and there is not a single mark made by an American in the nomenclature of the science, and he says that those with whom he talked expressed the intention of altering all this in case such a congress is held. This admission, by such men as W. E. Ayrton, W. H. Preece, M. Hospitalier and others, is a long step towards the accomplishment of the desired end, and if the congress is held under the proper auspices as advocated by ELECTRICITY and the necessity of which is emphasized by the electricians named, the new units and their names will be recognized throughout the world as duly authorized and official.

* * *

Mr. Hornsby's Report. We print in full in this issue the very interesting report just presented to the Director General of the World's Columbian Exposition by Mr. J. Allen Hornsby, the Secretary of the Department of Electricity. Mr. Hornsby recently made a flying trip to Europe to inspect the Frankfort electrical exposition, and to interest electrical men in Europe in the World's Fair. How much he accomplished in a very few weeks can be seen from his admirable and comprehensive report. He enters minutely into a description of the Frankfort exposition, its organization, financial management and results, and points out the special features which appealed to the observation of an American electrician. As he says, his experience will prove of much value in his future work in connection with the electrical section of the World's Columbian Exposition and no intending exhibitor, in fact, no one at all interested in the World's Fair, can read his report without profit. One point is certainly worth referring to as indicating a possible way out of the difficulty of insufficient space in the Electricity building which threatens the electrical section. Mr. Hornsby refers to certain detached exhibits which were allowed in the case of large exhibitors who wished to construct their own buildings. We have seen the same thing done before at other exhibitions with marked success, and it may yet be possible to provide for a few small electrical annexes at the World's Fair, to relieve the Electricity building proper, which, as has been pointed out from the very outset, is too small for the purpose for which it was designed. A very encouraging part of Mr. Hornby's report is devoted to the results of his conversations with the representatives of various important electrical firms in Europe. He states that already several of the largest firms in each country he visited, have stated their intentions of making exhibits at Chicago in 1893. As these large manufacturers have already made known that they will be represented, there can be little doubt that others and manufacturers of specialties will fall in line in due time, and that the electrical section of the World's Fair will be thoroughly international.

* * *

Conduit Electrical Railways. In an interview by a representative of ELECTRICITY with Mr. Stephen D. Field in regard to conduit systems of electrical street railroads, the latter expresses entire confidence in their practicability, and ascribes their ill success heretofore to cheap and careless construction. While this is probably in a measure true, Mr. Field evidently underestimates some of the difficulties inherent, apparently, in the system, notably that of insulation. He thinks that sufficient insulation can unquestionably be secured, but the fact is that this has been one of the chief difficulties in all of the attempts thus far made, and they have not all been careless nor cheap. But it is implied that he has a new system in mind, for he says: "The point of contact between the trolley and the working conductor must be protected or shielded by some kind of *insulating* medium," etc. If Mr. Field knows of a method by which the contact between trolley

and conductor can be insulated, and still permit current to pass to the motor, the question is certainly solved; but we imagine that he is somewhat confused on this subject. He also says that "conductors should preferably be composed of soft iron, re-inforced by copper for the sake of improved conductivity," forgetting or not knowing that such conductors have been repeatedly suggested and tried, and abandoned as introducing greater faults than they were intended to correct. His object in suggesting iron wires appears further along where he states that "a magnetic trolley should be used" because "it possesses the excellent recommendation of providing an intimate electrical contact." We presume he means that the attraction between the wheel and the wire would prevent the former from leaving the latter as is so often the case with street railroad trolleys, but a little consideration will show how inefficient such means would prove. No matter how strongly magnetic the trolley might be, it cannot attract the wire with increased force after the latter has reached a state of magnetic saturation, and with wires of the size that would be practicable for Mr. Field's purpose this state of saturation would be reached before any great tractive effort could be exerted. We think Mr. Field will have to revise his plans somewhat radically before he can hope to construct a successful conduit electric road.

* * *

ERRATUM.—In the article by Mr. Eustace Oxley, on "An Improved Phonograph Recorder," in our last issue, the name Mr. W. F. Cole, should read Mr. G. W. Cole.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The past month has been an exceedingly busy and prosperous one at the Columbian Exposition grounds. More noticeable results were accomplished than during any previous month since work began on the buildings. Superintendent of Construction Geraldine's report of the operations during the period, shows that the most gratifying progress has been made in every department and especially in the Electricity building, for the construction of which 700,000 feet of lumber were sawed and cut into shape, making a total of 1,624,272 feet that have been prepared for its construction up to date.

The temporary power-house which was illustrated in the last issue of ELECTRICITY has enabled the work of construction to be pushed very rapidly during the last week, both by furnishing light for the laborers to continue their work during the night and by supplying power for the contractors to run their saws, planers and boring machines.

In the temporary electrical construction, 175 poles have been set for permanent use, twenty-five poles for temporary use, and about six miles of line-wire has been put on poles. One 125 horse-power generator is installed. There are 175 incandescent lamps in service, sixty-six arc lamps in temporary service, and the office, engine-house, hospital and barn are wired for incandescent lights.

When Herr Wermuth, the Imperial Commissioner from Germany, was in Chicago he estimated that about 20,000 square feet would be necessary for the German manufacturers of electrical machinery in the Electricity building. Since he returned to Germany and talked with the manufacturers of that country he has thought it advisable to double the amount of space previously applied for.

The grounds and building committee approved this week the arrangement of the restaurants as submitted by Chief Burnham. The restaurants in the Electricity building will probably be the most attractive, in point of location, of any on the grounds. They will occupy the two round bays in the gallery at the north end of the building. These bays overlook the lagoon and the island and the view from this point will be spirited enough to induce digestion to wait on appetite. The bays are in size 96x68 feet, in the inner area of the bay, and will be surrounded by a semi-circle of nine private dining-rooms, each 16x18 feet in size. There will be a kitchen for each restaurant, and a series of nine dining-rooms. The two restaurants will seat 475 people, and the eighteen dining-rooms will accommodate 250. In each bay, encircling the series of dining-rooms, is a balcony 24x115 feet in area, and guests will be served there in fair weather.

MULTIPHASE CURRENTS.

So much has been said about the three-phase alternating current on account of its adoption in the Lauffen-Frankfort transmission experiment that the public have been led to believe that it was almost necessarily the coming method for long transmissions. The "drehstrom," or rotating polarity of the field, certainly has the advantage at the present time in that by its employment it is possible to operate alternating current motors so that they will start from rest with a full load —an accomplishment which we believe has not yet been realized with the single phase current. But we confess that we could never see any advantage in the multiphase current for transmission purposes *per se*.

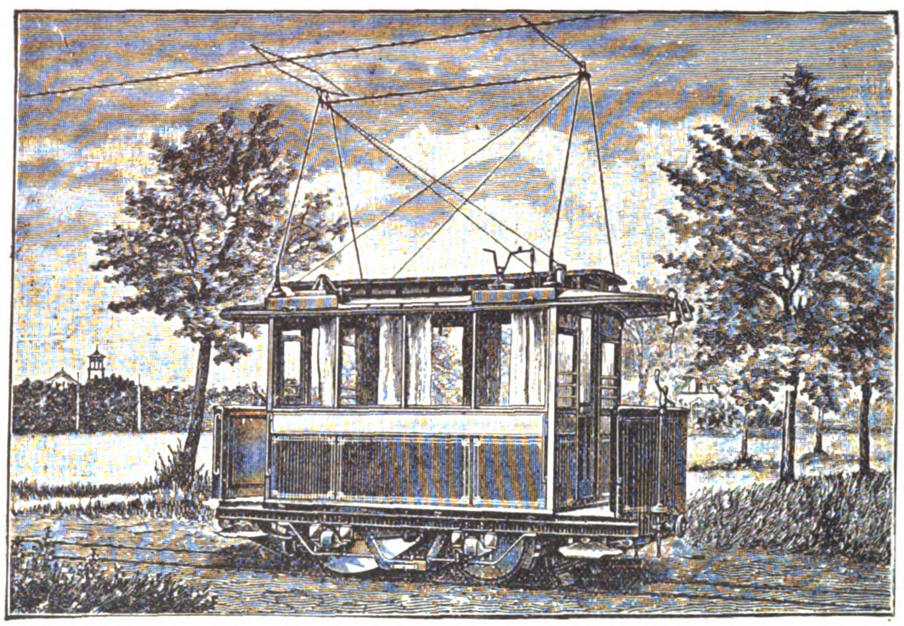
Mr. C. E. L. Brown, who designed the machinery for the Lauffen experiment, is of the same opinion and in a letter to the London *Electrician* expresses himself thus:

"The general reports upon the Lauffen-Frankfort transmission give the impression that to the application of the three-phase current is due the favorable issue of the experiment. I wish, however, to call your attention to the fact that the principal object of the experiment was to prove the possibility of transmitting high tension currents over long distances by naked wires, and with such a degree of security against danger and such a small amount of leakage as to demonstrate that this mode has a right to exist commercially. The adoption of the three-phase current only increased the difficulties to be met, since the generator, the transformers, switches and controlling appliances, as also the conductors—a most important disadvantage—became more complicated than they would have been had the usual alternating current been chosen.

"The only reason justifying the choice of the three-phase current was to demonstrate its advantages when applied to several small motors at the same time. * * * I quite agree that as soon as a practical single-phase motor is produced we shall not hear much about multiphase currents, except in some special cases, as for distribution of power in a big workshop where we need no transformation, and perhaps, also, for mining purposes."

SIEMENS AND HALSKE'S ELECTRIC CAR SYSTEM.

On looking at the accompanying cut one would be inclined to think it a representation of a system of a past age. It is not, however, but represents a car running on the Lichterfelde line, in Germany, constructed and equipped by the well known firm of Siemens and Halske. The same firm, about five months ago, equipped in a very similar manner a road from the Opera Place, in Frankfort, to the exposition grounds—a distance of 1440 yards. On this latter line there are three sidings and but a single curve of about 40 feet radius, and the current is supplied at a pressure of 800 volts.



SIEMENS AND HALSKE'S ELECTRIC CAR.

The cars on the Frankfort line have the same kind of rectangular trolley as represented in the cut, but there is only one instead of two. It is found that this form of contact answers the purpose very well, and sidings are taken without difficulty. It is evidently impossible for the trolley to get off the wire, in the sense in which we use the expression, but it is found that where there is but a single trolley, as at Frankfort, it sometimes jumps from the wire, momentarily, causing a spark, but this is obviated on the Lichterfelde line by the use of two trolleys.

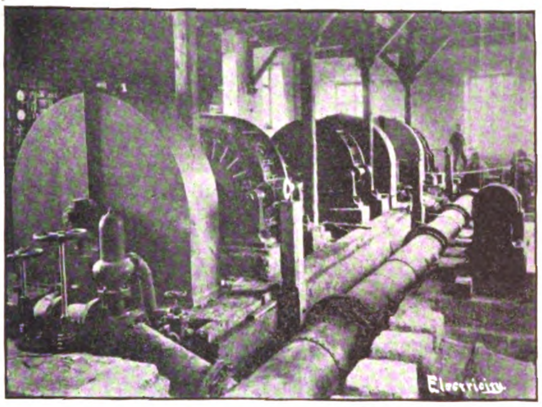
When the car reaches the terminus of the road it is not necessary to pull the trolley arm down and swing it around into position before starting in the opposite direction, as with the ordinary trolley wheel. The car is merely started back and the friction of the contact holds the trolley in position on the wire while the car passes under it until it assumes the ordinary position of a trolley on a car going in that direction.

It would naturally be supposed that a trolley of this kind which maintained sliding contact, would soon wear out, but experience has proved the contrary. We are indebted to the London *Electrician* for the above description and for the accompanying cut.

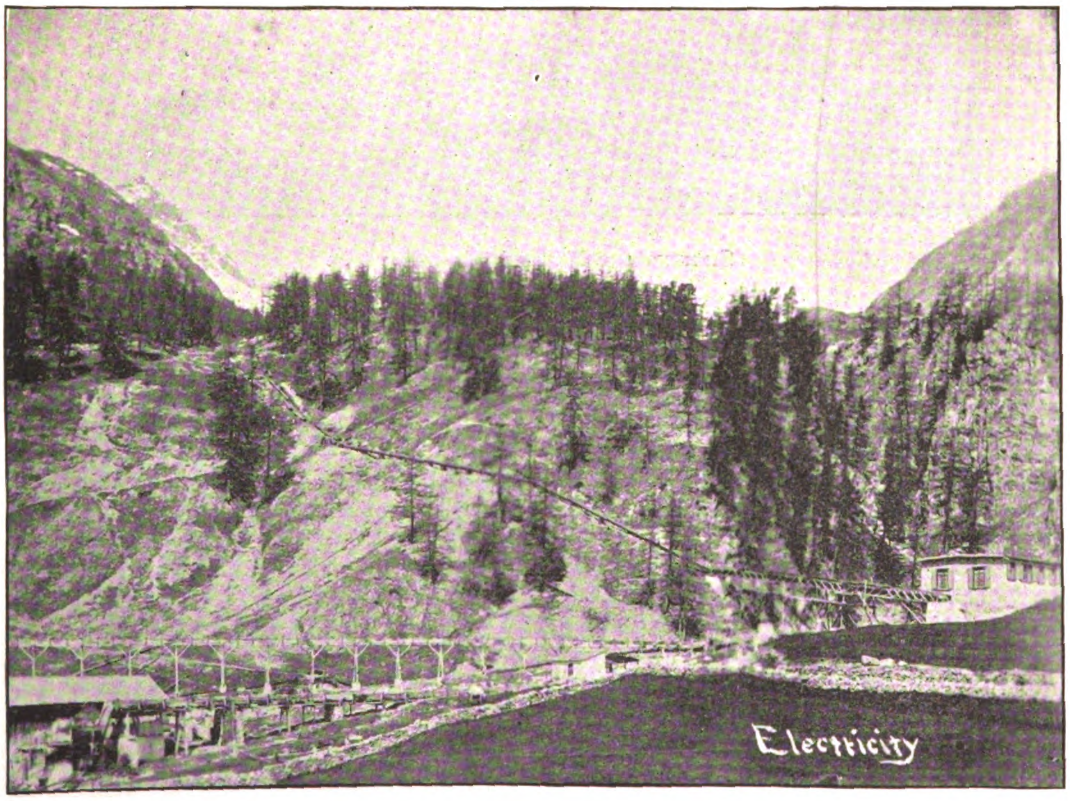
Professor Elihu Thomson is the subject of a long article in the *Boston Globe* for Oct. 25. Many interesting details were given of the Professor's busy and successful life, and the article as a whole was a well deserved tribute to him as a man as well as one of the world's most brilliant inventors.

ELECTRICAL TRANSMISSION OF POWER AT ST. MORITZ, SWITZERLAND.

At St. Moritz an extensive central station plant, driven by water power, has recently been constructed by Sternemann and Werssenback, of Zurich. The water is taken to the station through a line of piping about 26 inches in diameter, over a distance of upwards of 800 yards, and a fall of nearly 600 feet is obtained. In the line of piping there are six expansion joints to allow for changes in the lengths of the pipes due to variation of temperature.



The total amount of power available is about 1,000 h. p., The water motors at present installed in the station are three turbines of 160 h. p. each. Each turbine is directly connected to an alternating current dynamo of 80 kilowatts capacity. These three machines are connected in multiple and have an automatic regulator to maintain the pressure constant at 3,000 volts. The main line is about three miles long, and is constructed of bare overhead wires, supported on oil-cup insulators.



Current is supplied to five transformer stations having a total capacity of 25 converters which reduce the pressure from 3,000 to 100 volts. The plant is at present supplying current to 3,000 incandescent and 20 arc lamps.

Another water-power station will shortly be equipped at Stillowitz-Dorf. There is a water fall of 75 feet, from which 700 h. p. can be obtained. Two turbines will be installed, one of which will be used for driving two 80 kilowatt alternating current dynamos and the other for driving two continuous current machines. The current generated by these machines will be distributed on the three wire system, as the distance to the centre of distribution is comparatively short.

Our illustrations show a view of the pipe-line and the station and the arrangement of turbines and generators.

THE UNDERGROUND ELECTRIC CONDUIT FOR STREET RAILWAYS.

In view of the extent to which electric traction is now superseding the cable as well as the horse, any information regarding the latest development of the electric conduit for street car work is interesting and valuable. A representative of Electricity recently called on Mr. Stephen D. Field, who is well known as one of the first authorities in the country on the subject, and requested his opinions as to the present commercial feasibility and the future possibilities of the electric conduit system.

On being asked why the conduit system had not progressed as rapidly as the trolley system, Mr. Field said:

"The fault does not lie with the system, but with the way in which it has been handled. It is a comparatively expensive system, and a good conduit line cannot be built without spending more money than would suffice for a trolley line. The mistake has too often been to go in for cheap construction, and the poor work which naturally followed could not fail to prejudice the system."

"Putting aside the question of cost, are there difficulties in the adoption of the conduit that do not exist with the trolley?"

"None, and beyond that, the conduit system is more trustworthy in its operation, in that it can be more solidly constructed and have larger working conductors."

"Has it not been the general impression that one great difficulty with the conduit is the lack of sufficient provision for insulation?"

"Yes, but that is a great mistake. Thorough insulation can unquestionably be secured. The conduit must, in the first place, be mechanically strong enough to sustain, without yielding to, the ordinary traffic of a city street. It should preferably be constructed of cast iron ribs, with cement-lined walls. The slot should have an opening of not more than ¾ inch. The conduit itself should have as great inside clearance as can be had consistently with a firm surface structure. The conductors should be placed in the conduits in such a way as to have at least four inches clearance in every direction from the surrounding walls of the conduit, or any earth connection. Conductors should preferably be composed of soft iron, reinforced by copper for the sake of improved conductivity. The insulation should be similar to that employed on regular telegraph lines and should have a resistance of at least one megohm per mile under all climatic conditions. Contact between the vehicle moving on the rails and the working conductor in the conduit should be by means of a rolling trolley. The point of contact between the trolley and the working conductor must be protected or shielded by some kind of insulating medium, as sparks and flashes which sometimes occur between the moving contact and the working conductor will fly or be attracted to any adjacent iron work and form an arc, which may result in a breakdown. A magnetic trolley should be used and this is very simple in design, and possesses the excellent recommendation of providing an intimate electrical contact with little resistance to rotative progression. An insulator very similar to the well known Brooks insulator, which for a long time was generally used in telegraphic work, is well adapted for supporting the working conductor, only as the nature of the work involves great mechanical strains it should be made very much larger and stronger than anything yet attempted. These insulators must be placed in such a position that that they can be readily removed, cleaned and replaced."

"There have been several installations of electrical conduits in various parts of the United States, none of which possessed all the mechanical elements in that degree of excellence which is necessary to a practical system, and none of which showed a standard of insulation equal to that of an ordinary country telephone line. Either of these objections is sufficient to account for the failure which has hitherto attended the attempted exploitation of the conduit system."

"Can you give a general idea of the cost of installation?"

"A good electrical conduit would cost in the neighborhood of $30,000 per mile for each line of track equipped. This is far less than has been expended in laying down the lines of many cable railroads now in operation in the United States. Then again the cost of operation of an electrical conduit road should be far less than that of cable lines, for the reason that the cost of operating by electricity is directly proportional to the number of cars employed, while with the cable system the entire cable has to be in operation and hauled at constant rate of speed over the entire length of the road, no matter whether one or the full complement of cars are in operation. Again, it requires about 10 horse-power per mile to move the cable without any car attached, a source of expense which is entirely absent in electric traction."

"What do you think, Mr. Field, of the chances of an electrical conduit service superseding that of the cable on the Broadway line?"

"On that subject I am not prepared to give an opinion. That the change could be made there is no question, in spite of the fact that the Broadway cable has not been constructed in such a way as to make the substitution as easy as it generally is. As to whether it will be done or not we can only wait and see. Dividends are very strong arguments, and the experience of the past has been that when the owners of cable roads once overcame their prejudice and looked solid figures fairly in the face, the change to electric traction soon followed. The conduit system has of late been so developed, both here and in Europe, that its pre-eminent suitability for city street traffic will soon be generally recognized. If the Broadway company eventually find that at a very slight sacrifice they can have not only an infinitely better and more flexible service, but can also make a

great deal more money, it is but natural to believe that the change is within the bounds of possibility.

"What would be the cost of the change?"

"Probably somewhere around $5,000 per mile, but that could be determined only after a thorough investigation into all the conditions."

"What would be the specific advantages of the conduit system?"

"The conduit system would be more trustworthy in operation than the cable. It is infinitely safer, so far as damage to property is concerned, than the existing trolley lines, and as the conductors are placed out of reach of the passengers there is no danger from shock. Thus higher potentials can be used. The system can be operated without any interruption of the street traffic. The rails can be flush with the street so that they can be driven over in every direction by the lightest vehicle without any sensible jar. Owing to this feature of unobtrusiveness the conduit system can be laid and operated in many localities where other systems would be prohibited. On the other hand I may say, and it appears to me that it closes what I have to say on the subject for the present, there is no obstacle whatsoever to the introduction of electric conduit roads which cannot be overcome by an intelligent expenditure of a reasonable amount of money."

A CORRECTION. THE EDCO NOT THE EDISON.

In speaking of the Dubuque, Iowa, Street Railway, in our issue of Oct. 21st, the types made us say that the system employed was the *Edison*, when we intended to say the *Edco*. Our attention has been called to the error by the following very polite note:

PHILADELPHIA, Nov. 6, 1891.

EDITORS OF ELECTRICITY.

Gentlemen: In ELECTRICITY of Oct. 21st, page 186, you note that President Rhomberg of the Dubuque, Iowa, Street Railway, operating the *Edison* system of accumulator cars was in Chicago; and that "the cars are giving much satisfaction, and the residents are delighted with the excellent service given by the railway company."

The item is correct in every respect except that it is the "Edco" and not the Edison system which is being operated in Dubuque. Edison has put out so many good things that a mistake of this kind is quite easy; but the Edco system is good enough to stand on its own merits. The cars running commercially in Dubuque and Washington, D. C. are entirely satisfying the patrons of those roads and the general public, and are also winning the approbation of the many street car managers who have seen them in operation.

Yours truly,

THE ELECTRO DYNAMIC CO., OF PHILA. (EDCO.)

E. A. SCOTT, Supt.

We are obliged to the The Electro Dynamic Co, for calling attention to this mistake, and gladly make correction.—ED. ELECTRICITY.

FOREIGN EXPOSITION NOTES.

In Russia they manage exhibitions on a plan very different from that which obtains in this country. At the Russian exposition at St. Petersburgh a little over $7 per square metre is charged for floor space, and $3.50 for wall space. If any article is sold during the exposition 10 per cent. of the selling price must be paid to the Executive Committee. Foreign exhibits are admitted to the country duty free on condition that they re-cross the frontier within a month after the close of the exhibition. All objects sold at the exposition must pay the usual duty.

It is said that the Executive Committee at the Frankfort Exposition have in some cases refused exhibits on the ground that there were already enough of a similar class. In this way the exhibits of different firms were prevented from overlapping each other. It seems to us that it also prevented competitive exhibits, which are certainly a desirable feature of exposition displays.

The number of visitors at the Frankfort Exposition exceeded 1,200,000 and it is thought that the receipts will equal the expenditures, and there will be no necessity for calling upon the guarantors.

The testing jury is still at work on the Lauffen-Frankfort transmission plant, and they will probably push the voltage gradually higher and higher till the insulation breaks down.

Messrs. Siemens and Halske continue their experiments with high potentials at Frankfort. Late advices state that they had reached a voltage of 48,000 with a Siemens (London) cable without injury to the insulation. It is noted with some surprise by the *Electrician* that the arc produced by this enormous pressure was inferior in point of brilliancy to that made by half the pressure. We do not understand why this should cause surprise as it is well known that the higher pressures produce less luminous and more actinic rays than lower pressures—the purple end of the spectrum predominating in the former.

MR. HORNSBY'S REPORT ON THE WORLD'S ELECTRICAL CONGRESS OF 1893.

As a part of my work in Europe, under instructions from the Chief of the Department of Electricity, I visited several of the scientists of England and the continent in behalf of an international electrical congress, for the success of which the Chief of the Department of Electricity has been working since his appointment, and I am prepared to state that the success of the congress is assured; providing, of course, it is prepared and carried out in a manner satisfactory to the scientific men who will create its dignity and make its chief value. Among those whom I conferred with regarding this congress were Prof. Galileo Ferraris, of Italy, Dr. Siemens, of Berlin, Prof. W. E. Ayrton, of the City Guilds College, London, W. H. Preece, Esq., F. R. S., Electrician-in-Chief of the Telegraph Department of the British Government, M. Hospitalier, of Paris, and M. Abdank-Abakanowicz, of Paris.

The concensus of opinion expressed by these distinguished men and others of eminence, I set forth in the abstract as follows:

Hitherto electrical congresses have not been successful and essentially for the reason that the methods of their organization were not calculated to give them that dignity necessary to the accomplishment of effective work. In electricity there are practically no international electrical units such as are found in other sciences, and standards of measurements are not of that arbitrary character which would have grown out of official, authorized action in their establishment.

In arranging for such a congress as these men deem it necessary to have, they think the United States Government ought to father the invitations and that the congress should be held under government auspices; that invitations should be issued to individual scientific men of the world by the United States Government, through the governments of the countries to which the individuals belong. This course of action, in the opinion of the authorities whom I consulted, will insure an official character to the proceedings of the scientific congress, and will virtually pledge the various governments to a recognition and adoption of the standards created. If such a congress is to be held at all, it can only be a success along these lines. Past experience has determined the men without whose aid such an affair would fall flat, and who would decline participation in any congress which has for its end less than the work outlined above, and they have come to the conclusion that the World's Columbian Exposition shall mark a distinct epoch—and the greatest one in the history of electricity. Further than this, it is admited that while Americans have done at least their part for humanity in the science, there are no recognized units credited to Americans and there is not a single mark made by an American in the nomenclature of the science. It is intended to alter this in case such a congress shall be held.

To carry out such a work as these scientific people picture to themselves, they would have established a purely scientific committee embodying a member from each of the important governments—at least from those which have contributed materially to the progress of electrical science—the duty of which committee should be to prepare a programme including a settlement of the issues to be discussed, and the individuals to take part in this discussion; to attend to the preparation of scientific work, etc., in fact, to prepare for the congress in all directions appertaining to science. Another working committee should also be appointed, for the preparations other than scientific, to include gentlemen interested in the commercial success of electricity, and this committee could also convene, if it were deemed advisable, a congress of electrical engineers to indulge in discussions of the commercial value of the applications of electricity.

One other point was made by European scientists, namely, that such a scientific congress should be convened in August or September, as those months constitute the vacation of European professors, and the majority of the desirable electrical scientists of Europe are teachers in the educational institutions. They would probably not be able to attend during any other season.

In conclusion I beg leave to report that Europeans fully appreciate the magnitude and completeness contemplated for the World's Columbian Exposition, and that they have arrived at that point in their enthusiasm where their chief topic of discussion in connection with it is that of the sufficiency of the means of ocean transportation for passengers and freight.

All of which is respectfully submitted.

(Signed) J. ALLEN HORNSBY,
Secretary, Department of Electricity.

FOREIGN EXHIBITORS AT THE CHICAGO EXHIBITION.

The Americans are, to some extent, exercised as to the probability of many English firms declining to exhibit extensively at Chicago, and there is, no doubt, the same likelihood of exhibitors in other European countries holding aloof. The question put by European firms is: Will exhibiting pay? To make it pay it must be useful as an advertisement and extend sales in America or at home. It is questionable whether English manufacturers can sell goods in America to any extent. This arises, not so much from tariff difficulties, as from the difference in the methods of doing business. For example, most electric lighting in America is done by off-shoots of a few large manufacturing companies, with "systems." In England one firm makes engines, another makes dynamos, and so on. There is certainly a tendency among American electric supply companies to throw off the yokes of their parents, and to buy machinery in the open market, and this feature may help European manufacturers. In the open market, and with prejudice discounted, English electrical machinery could, we think, easily compete with American, but probably both might be beaten by the manufactures of Continental engineers. Under the present conditions of American electrical industry it is scarcely likely that any European firms will exhibit heavy electrical machinery at Chicago. Mere accessories, such as

measuring instruments, may be shown, but we can think of nothing else that it would pay to send there.

No doubt a certain obstacle in the way of doing trade is a kind of provincial prejudice in favor of American goods. We can understand this failing in our cousins all the more easily as we have it to a certain extent in this country. If, for example, some one here wishes to buy a watch, he is shown, say, a good American article, made well but inexpensively by automatic machinery on the interchangeable system. He is also shown a watch made in England which is unique that is to say, it is different from every other watch, and has had its parts made separately by hand. He is assured that the latter is genuine English work, and much superior to the foreign article. It is said to be cheap at three times the price asked for the former.

It has been urged that if we cannot sell electrical plants we may be able to sell patents, but patents are not bought by the public who would be impressed by an exhibition, but by electrical firms or companies who can be dealt with directly. The inventor of, say, a new direct-current transformer would not exhibit it at Chicago; he would write to or call upon the few companies who might take such a thing up, and they could be counted on the fingers of one hand. Until the "system" method of doing business dies out in the United States, we fear it is unlikely that European firms will sell or exhibit plants in America, unless the publicity is so extensive as to act as an advertisement at home by a sort of reflex action.—*Industries.*

FROM NEWS CENTRES.

NEW YORK.

NEW YORK, Nov. 7.—A decision was recently given in the United States Circuit Court by Judge Coxe, granting a permanent injunction against the Julien Electric Company from infringing the patents of the Electric Accumulator Company, by using storage batteries on street cars and in other places. The defendants have asked for a re-opening of the case, on the ground that a Spanish patent of the Accumulator Company, by expiring, had invalidated their patents in this country. The evidence placed before the judge as to the lapsing of the Spanish patent was obtained by an attorney who went over to Madrid for the purpose of securing it. It was not, however, considered satisfactory, as the judge wanted certified copies of the Spanish patent, as well as of the French patent, so as to be able to pronounce absolutely as to their date of lapsing. Judge Coxe has now decided that the injunction must stand.

Among the many signs of increasing demand for telephone service is the incorporation, at Albany, of the Shaver Telephone Company, of Fulton and Hamilton Counties with a capital of $25,000. The general route of the lines will be from Johnstown to Gloversville, Broadalbin, Mayfield, Northville, Wells and Sageville, and each and every dwelling house and place of business in Fulton and Hamilton Counties, N. Y., can obtain connection.

The Board of Electrical Control has obtained its first conviction in the courts for violation of the laws in reference to stringing wires above ground. This decision was pronounced in the court of Special Sessions against linemen in the employ of the Acoustic Telephone Company, who were convicted and fined for stringing wires across the streets from housetops without a permit from the Board. The company contested the case on the ground that its wires carried no electricity. The decision establishes a precedent, and in future no telephone or messenger company can string wires above ground from poles or house tops without the permission of the Board. There will be no appeal.

An indication of the interest which is taken in the plans now being considered for the improvement of city passenger travel is the announcement that at the next formal dinner of the Commonwealth Club the subject for discussion after the viands are disposed of will be "Rapid Transit." A number of experts have been invited to give their views on the subject, and it is expected that ex-mayor Abram S. Hewitt will be present.

A crucial stage of the work of the Rapid Transit Commission will be entered on Wednesday next, when the canvass for the consent of the owners of one-half the property along the lines of the proposed underground roads to the construction of those roads will begin. If the required consents shall be obtained, the next step will be to prepare detailed plans and specifications for the construction of the railway and to offer the franchise for sale at public auction. The failure to secure such consents will involve a long delay, for application will have to be made to the General Term of the Supreme Court for the appointment of three commissioners, whose duty it will be to hold public hearings upon the question whether or not the proposed roads should be constructed, and to report their decision to the General Term for final action.

The use of only four tracks below Union Square and eight tracks above is generally regarded as a serious, if not fatal defect in the proposed system. It is claimed that if the eight tracks are necessary to accommodate the travel above Union Square, they are certainly necessary below that point, and that the conversion of two four-track roads into one at that point will result in the destruction of any thing like rapid transit for the lower part of the city. Another objection, which appears to be equally well taken, and is certain to be a prominent element in the problem that will confront capitalists when they come to consider the franchise of the road as an investment, is that the single four-track line under Broadway would bring east-side travellers far out of their way.

G. H. G.

BOSTON.

BOSTON, Nov. 7.—The Selectmen of Hyde Park, Mass. have granted a franchise to the Norfolk & Suffolk Street Railway Co., for the construction of an electric railway from Boston to Dedham, via Hyde Park. This will be a great convenience to thousands residing throughout that populous territory.

The work of equipping the street railway from Lynn to Peabody is now well under way and electric cars will be running in a very short time.

From Dec. 1, next, the town of Edgartown, Mass., is to be lighted by electricity, a plant for both street and commercial lighting being well nigh completed.

Two Westinghouse 1,000 light alternating machines of 2,000 volts potential each, have been ordered by the Brookline, Mass., Gas Light Co., and will soon be in operation.

The W. S. Hill Electric Co., which was recently organized for the manufacture of the specialties invented by the president of the company, is having to decline contracts, being unable, even with its doubled up manufacturing facilities, to keep pace with the demand. An entirely new and extensive factory is likely to be a necessity ere long.

The Schuyler Electric Co., of Middletown, Conn., is finding it difficult to keep up with the extraordinary demand for its specialties. It has now in hand the entire equipment of a central station in Scranton, Pa., another in Niles, O., and is supplying machines for the enlargement of the electric light station at Holyoke, Mass., where already there are 18 Schuyler dynamos in regular operation. The company has found it necessary to built and equip a brass foundry for its own use as it is now using over seven tons of brass weekly, all of which is worked up in the manufacture of its own goods. The company was never more busy than at the present time.

After trying for some time to have the fire alarm system and the inspection of electric wires in this city cared for by two distinct departments, it has been found impracticable, so the two branches of the city service have been consolidated and Captain B. S. Flanders is chief over all.

The annual meeting of the Quincy and Boston Electric R. R. Co., was held in the first named city. A very satisfactory report was submitted for the past year, after which Mr. John R. Graham was elected President and Mr. F. H. Smith Secretary and Treasurer.

The course of free lectures, thirteen in number, on electricity, to be given in the Wells Memorial Institute, commenced last week, Professor W. L. Puffer, of the Institute of Technology, being the lecturer. A large and interested audience was present and the course is likely to be a particularly successful one.

Mr. Fiske, of the Thomson-Houston Electric Co., is giving a course of weekly lectures on "Electricity" before the members of the Y. M. C. A. at their Hall, corner Berkley and Boylston streets.

The "W. P." motors recently placed on the market by the Thomson-Houston Motor Co., are exciting general attention and already large numbers are being shipped to the west.

The increased number of long eight-wheeled electric cars now in use on the newly equipped sections of the West End Electric Road are pleasing the public more and more, and traffic on the Jamaica Plain section is said to have already increased 25 per cent.

The contract has already been let by the Lynn and Boston Railway Co, for the erecton of a new power house. Three 350 h. p. engines will be located in the building as early as possible, the ultimate intention being to have an equipment of 5,000 horse power in the station.

Mr. Charles E. Fuller, late of the firm of Seth W. Fuller, the oldest established electrical firm in Boston, has commenced business at 22 Milk street, where he will carry a full line of annunciators, bells, speaking tubes, incandescent lighting and other electrical supplies, and do a general construction business.

The Germania Electric Co. has secured a contract for the complete equipment of a central lighting station at Pascoag, R. I. W. S. K.

MONTREAL.

MONTREAL, November 7.—The great benefit which the proposed electric street railway will prove to those residing in the more thickly populated parts of the city of Montreal can hardly be over estimated. It is proposed to run this road up through some of the most central streets, to the outskirts, where it will connect with the cars of the Mount Royal Inclined Railway Co. Leaving the outskirts it will than pass through Montreal Annex, to the Canadian Pacific Railway tracks, where it will terminate and where the power-house will be situated. The chief object of running out as far as the tracks is to give easy access to the city for the large number of employes, who will be stationed in the new freight yards of the company. At least 800 men will be employed permanently in the roundhouse, car shops, freight sheds and sidings of the C. P. R. All freight trains coming and going will be billed there, thus making an additional 700 men such as trainmen, engineers, firemen, brakemen and conductors, who will be more or less concentrated there. The electric railway will serve as an easy means for the transportation of these employes to and from the city. It will also open up a new district in the land adjoining Montreal Annex for residences. This will be a great advantage to those mechanics and many others who wish to combine pure air with economy in living. Should the city council decide in sufficient time to insure the equipment of the cars, the company will commence work on the road as soon as the snow is off the ground next spring and propose to have the cars running a short time thereafter.

A branch of the Canadian District of the Edison General Electric Co. was established here about six months ago, in the Temple building. It has already a plant of some 2,200 lights and operates about 40 horse-power in motors. When the company's installation increases to a sufficient size, it intends running a complete system of underground wiring as in Toronto, where the plant consists of some 20,000 lights.

The Harbor Commissioners have given the contract for lighting the harbor to the Drummond-Clarkson Syndicate Co. for four seasons, commencing with the opening of navigation in 1892. The plant will consist of 50 arc lights run on the Edison system and will be supplied at 30 cents per lamp per night. The same company has also the contract for lighting the suburbs of Cote St. Antoine, Cote St. Henri and Cote St. Paul. The plant which is situated at Cote St. Henri will be 150 h.p. and will operate three 50 h.p. Edison generators, supplying for Cote St. Antoine, 30 arc lights and 100, fifty c.p. incandescent lamps; for Cote St. Henri, 100 lights; and for Cote St. Paul, 15 lights. This system is to replace the Craige, which was formerly used in these suburbs.

The suburb of Maisonneuve has experienced considerable difficulty in endeavoring to obtain the electric light. A short time ago, the Council decided to have the municipality lighted by the electric light. The Edison Electric Light Co. sent in a tender, agreeing to furnish the lights for $10,900 per annum, while the Royal Electric Light Co. sent in one agreeing to do it for $9,500. As the majority of the Council were more favorably disposed towards the Edison tender the matter was referred to a subsequent meeting, at which a supplementary tender was received from the Edison Co. for $9,400. The vote being taken the contract was awarded to the Edison Co., which the Mayor refused to sign. Although a good deal of confusion has resulted, the Edison people have practically the contract for supplying the lights, which are to be 30 arc and 400 incandescent.

One of the largest private plants, where power

can be rented, is that of the *Gazette* Printing Co. which is of 2,000 light capacity, operating two 1,000 light Edison generators. Besides supplying power for lighting, the company also furnishes it for motor circuits.

The Grand Trunk Railroad Co. are changing the storage cells hitherto in use for lighting many of their parlor and sleeping cars, for the Robert's storage cell, claiming for the latter greater efficiency.

H. T. B.

SAN FRANCISCO.

San Francisco, Oct., 19.—Electricity as the motive power to relieve street passenger traffic is rapidly winning its way to the fore in this city. It is a hard and stubborn fight, for the cable companies have a tight grip on our thoroughfares. Besides the people have long been accustomed to the comfort, facility, and despatch of the cable road and the mass of the people still regard electric roads in the light of something still in the experimental stage. Across the bay however, in Oakland, where the trolley system has been running for over six months it is the most popular system in use. What some of our local capitalists and men who make street traffic a study, think of eiectricity as a motive power came out in a recent meeting of the Board of Supervisors. One of the members called attention to the fact of the increasing number of petitions for electric roads; he said it was time that the Board took up the discussion whether or not electricity was to be used as a motive power within the city limits. A number of representatives of the big car lines in the city who were present, declared electricity to be the coming motive power for street car traffic. J. J. Haley, a representative of the Market street cable system, endorsed electricity by saying that the Supervisors would have to recognize it and adopt it. Michael Skelly, of the North Beach and Mission R. R. Co., (horse cars,) declared electricity was rapidly becoming the favorite motive power of the country So confident was his company of its merits that he was there to petition the Board for permission to transform the Solsom street branch (horse car) of the corporation into an electric line.

A franchise has just been granted local capital to build a street car line down Sixth street to South San Francisco. A cable will furnish motive power to South San Francisco and thence electricity will be used. Electric fittings and furnishings are being rapidly introduced into all the big down town buildings and the Edison Company has been given the contract to supply the electrical fittings for the new Mills Building on Montgomery street.

The Board of Supervisors have adopted a resolution requiring the telephone, telegraph, and electric light companies having poles on Mission street from Cortland avenue south to the county line, to take them down within thirty days under penalty of having them chopped down by order of the Superintendent of Streets. This is a continuation of the war against the erection of poles on public streets. Most of the wires have been buried on the main thoroughfares.

The electric railroads on the Oakland side of the bay, are extending their territory very rapidly. The Berkeley and Oakland line is building branch lines in several directions. The line from Hayward to San Jose is being pushed expeditiously. Recently the promotors of the latter line presented a petition to the Town Board of Los Gatos asking for a franchise for an electric road to connect that town with their main line. The petition will undoubtedly be granted as public opinion is strongly in its favor. The level stretch of ground in and around Oakland is excellently adapted for the building and running of street car lines. Oakland capitalists appreciate this fact as well as the fact that good service there means very excellent returns on the capital. Hence they are always on the lookout for the latest and best in motors. It was the Oaklanders who taught the people around the bay that the trolley system could be run with comfort, despatch and profit. Now they have taken another step and are building a storage battery electric road on Eighth street. The result is being watched with unusual interest. If it can be made a commercial success, the transformation of most street car lines into electric roads will be a matter of a few years. The San Antonio Electric Light and Power Company has gone to work in good earnest to give the people of San Bernardino cheap lights. It has developed water power in San Antonio canyon, and will soon furnish incandescent light and power to order at Pomona, Ontario, San Bernardino and other towns in the valley.

Santa Cruz has joined the rapidly increasing number of towns which have adopted electricity for street locomotion. A. P. Hotaling, a San Francisco capitalist, has purchased a controlling interest in the Pacific avenue railroad and will at once convert it into an electric road. Engineers are now at work figuring on the alterations and making estimates for the equipments. The road extends through the principal streets and out to the ocean beach, which is greatly frequented in summer for the surf bathing.

B.

A NEW ELECTRIC BELL DEVICE.

An ingenious improvement in electric bell construction has recently been invented by Mr. Richard Varley, of Passaic, N. J. It is an insulating lock-nut and connecting clamp for carrying the contact screw. The application of this device is shown in the accompanying illustrations, Figs. 1, 2, & 3. A soft rubber stopple (Fig. 2), is passed through a hole in the box of the bell, and to this is attached the connecting clamps (Fig 3) by the prongs shown. The contact-screw is then forced through the stopple, which holds it firmly. The complete arrangement is shown in Fig. 1. This littie device reduces the labor of assembling the bell and adds to its efficiency, as the contact screw cannot work loose in the rubber. It is put on the market by J. Jones & Son, of 602 W. 22nd St. New York City.

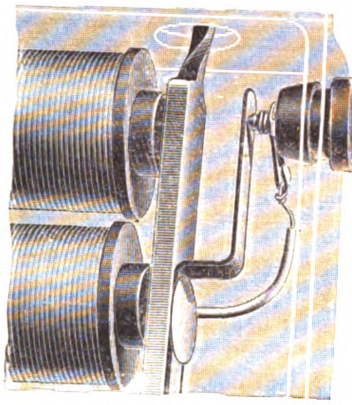
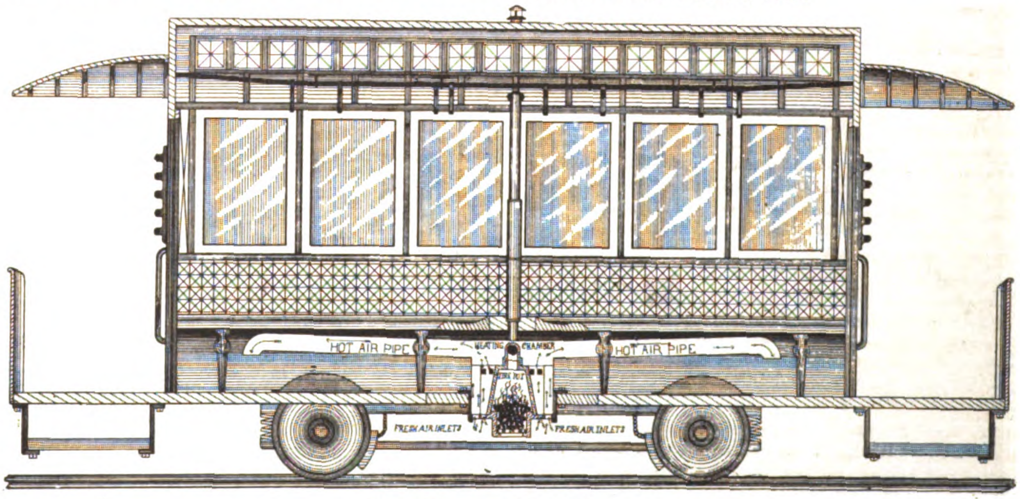


Fig. 1.

Figs. 2 and 3.

THE DUPLEX CAR HEATER.

With winter coming on apace the question of heating street cars arises again as actively as ever. Street railway managers have many different styles of heaters to choose from, some efficient some otherwise. That shown in the accompanying illustration has several points of recommendation. It is devised on the principle of a house furnace. Fresh air is taken from below into a heating chamber containing a concealed fire-pot; from here the heated air is sent through two hot air pipes and discharged into the lower part of the car, thus warming the car throughout as the hot air pipes radiate heat themselves. A constant circulation of fresh air is maintained and the car is heated from end to end. The size of the heater is $14\frac{1}{2}$ by 18 inches.



The Duplex Car Heater.

A large delegation of property-owners from South Chicago and the neighborhood waited on the mayor one day last week for the purpose of urging him to abandon his expressed determination to veto the South Chicago electric road ordinance passed at the last session of the council. They represented that although the right of way ran over many streets, it was not for more than two or three miles, and that the road was urgently needed by the people of South Chicago. After listening to the pros and cons of the case, the mayor said he would consider the matter, and it is now improbable that the ordinance will be vetoed.

REPORT OF TESTS ON THE "CHAMPION" BATTERY.

Stevens Institute of Technology,
Hoboken, N. J., May 9, 1891.

C. J. Hirlimann, Esq.

Dear Sir: I have made a careful series of tests, continued during two months, on your "Champion" Battery in comparison with the best batteries of the same type in general use, and as a result I find your battery to be an excellent one, equal to the best, and possessing some distinctions which in certain cases will give it an advantage.

Thus, on open circuit or with a high resistance it shows a higher electro-motive force than others in about the proportion of 15 to 14.

On closed circuit, through a low resistance, however, this advantage does not appear on account of the internal resistance of your battery, which is relatively high.

Your battery also shows a remarkable promptness in recovering its electro-motive force on the opening of the circuit. Thus, it will recover 50 per cent. of its loss in one minute, while other like batteries will only recover 10 per cent. in the same time.

The "Champion" Battery.

The entire record of my experiments is very voluminous, and I therefore have selected the following as expressing in a briefer form the character of the determinations.

	Champion.	Other Batteries.
Electro-Motive Force at starting	1.50 Volts.	1.38 Volts.
Resistance	0.26 Ohms.	0.17 Ohms.
H. M.		
3.00—Circuit close through resistance of 2 Ohms.		
3.03—Electro-Motive Force	0.89 Volts.	1.02 Volts.
3.05— " " "	0.82 "	0.97 "
Circuit opened until		
3.10—Electro-Motive Force	1.25 "	1.18 "
Circuit closed until		
3.15—Electro-Motive Force	0.74 "	0.88 "
3.15—Circuit opened.		
3.17—	1.00 "	1.02 "
3.19—	1.08 "	1.05 "
3.20—Circuit closed	1.11 "	1.06 "
3.21— " "	0.81 "	0.92 "

The circuit was then opened and closed at short intervals for two hours and was then left open for four hours, after which the electro-motive forces were: Champion, 1.30 volts; other batteries, 1.10 volts.

The circuits being open all night, the electro-motive forces were: Champion, 1.38 volts; other batteries, 1.25 volts; and after 2 minutes of closed circuit through 2 ohms resistance the electro-motive force was: Champion, 0.80 volts; other batteries, 0.90 volts.

The batteries were then left on open circuit until March 28th, when they showed: Champion, 1.41; other batteries, 1.29 volts. The circuits were then closed through a resistance of 200 ohms until April 20th.

Measurements of electro-motive force made during this interval were as follows:

	Champion.	Other Batteries.
March 29—Electro-Motive Force	1.31	1.21
" 30— " "	1.29	1.20
April 1— " "	1.27	1.19
" 2— " "	1.27	1.19
" 3— " "	1.26	1.18
" 6— " "	1.25	1.17
" 11— " "	1.24	1.16
" 17— " "	1.20	1.14
" 20— " "	0.90	0,80

Both sets of cells at this time gave evidence of exhaustion. Similar tests were made by running other cells through restances of 15, of 20 and of 75 ohms, with similar result.

Yours truly,

(Signed) Henry Morton.

PERSONAL NOTES.

Visitors to and members of the Chicago Electric Club will regret to learn that Mr. W. P. Sullivan, so long connected with that organization as manager, has resigned his position and already severed his connection with the club. Mr. Sullivan, by his accommodating and affable manners, has made himself quite popular with the frequenters of the club, and his genial face will be much missed.

Mr. W. R. Pinckard, manager of the house goods department of the Electrical Supply Co., of Chicago, has gone on a combined business and pleasure trip to the Pacific Coast.

Mr. G. A. Harmount, manager of the Monitor Electric Co., of Chicago, is confined to his bed by a nervous attack, brought on by overwork.

Mr. J. H. McGill has been appointed city salesman for the Electrical Supply Company.

THE WELLS MEMORIAL INSTITUTE.

The Wells Memorial Institute for Workingmen, of 987 Washington Street, Boston, has issued a neat little "Fall and Winter Prospectus," in which many inducements are offered to mechanics and workingmen and young men generally to join the Institute, which already has a membership approaching two thousand. The yearly fee is only one dollar. Numerous classes, courses of lectures and entertainments are announced. The "Lowell Free Lectures," conducted at the Institute through the generosity of Augustus Lowell, Esq., comprise courses on Electricity, the Steam Engine, Sanitary Engineering and Building Construction. These lectures are of a thoroughly practical character, designed to meet the needs of workingmen and mechanics. Those on electricity are divided into two courses, elementary and advanced, and will be delivered by Mr. Wm. L. Puffer, of the Massachusetts Institute of Technology.

COMMERCIAL PARAGRAPHS.

The following testimonial speaks well for the Burton Electric Heaters:

Escanaba, Mich., October 27th, 1891.

Electric Merchandise Company, 11 Adams St., Chicago.

Gentlemen:—The Burton Electric Heaters you sent to the Escanaba Electric Street Railway Company have been put to a good thorough test and have been found equal to the emergency. We have had some cold weather and quite a fall of snow but the cars have been as warm as toast. Your heaters are the simplest, cleanest and most efficient of any heating apparatus in the market.

You may use this in any manner you wish or refer to me at any time.

Respectfully yours,
(Signed) George W. Finch,
Elec. Eng.

The Engineering Equipment Company, of New York and Boston, have moved their New York office from the Central Building, 143 Liberty street, on the second floor to the ground floor, next the main entrance, in the same building. Their Boston office and salesrooms occupy the ground floor and basement of 126 Pearl street, in the heart of the steam and electrical equipment trade. Both of these locations are considered very advantageous to the business in which they are engaged. The officers of the company are: F. L. Perine, Gen. Man.; A. L. Tinker, Sec. and Treas.; C. J. Field, M.E., Consulting Engineer; F. A. Magee, M.E., Man. of Boston Branch; W. F. D Crane, M.E., in charge of Railway Department at New York; S. C. Merrill, representing the Underwood belting.

Mr. A. M. Morse, until recently of the firm of English, Morse & Co., Kansas City, has removed to St. Louis with offices in the Commercial Building, corner Sixth and Olive streets. The new firm will be known as A. M. Morse & Company and will represent leading manufacturers of high grade steam engines, both Corliss and high speed types, also boilers, steam pumps and other specialties that go to make up complete steam power plants.

Some time ago we announced in this column the intention of James W. Queen and Co. to remove from their old quarters at 924 Chestnut street, Philadelphia, to the more commodious ones at 1010 Chestnut street. They now announce that they expect to be settled at their new place by December 15th. Their new building which contains 26,000 square feet of floor space, will be lighted throughout by electricity, and the increased room will enable them to carry a more varied stock than ever before.

The Electrical Supply Co., of Chicago, have recently fitted out the front part of their large and commodious store on the corner of Michigan avenue and Randolph street as a sample and sales room. By this arrangement the company expect to make most of their retail sales by sample only and give better satisfaction to their customers.

The Electric Merchandise Company is still engaged with the same rush of business that has occupied its attention during the summer. For their standard line material, station and car equipment, continually increasing demand is reported, and large orders for Pratt's Portable Conductor's Register and Burton Electric Heater are being filled.

Notice is given that the Universal Arc Lamp Company have appointed the Interior Conduit and Insulation Company as their exclusive agents after November 1st, for the manufacture and sale of their apparatus. The Conduit Company take their current customers and assume all liabilities, and have devoted a large portion of their extensive factory to the new business they have undertaken. The business will go on as usual with the exception that it will be transacted hereafter in the name of the Interior Conduit and Insulation Co., instead of as formerly under the name of The Universal Arc Lamp Co.

The Crocker-Wheeler Electric Motor Company are doing a very flourishing business. Among their recent installations may be mentioned the following in New York City: Three 5 h. p. and two ¼ h. p. motors for Mr. Louis Sherry, the well known caterer, 37th street and Fifth avenue; one 5 h. p. in the Marlborough Hotel, running ice cream freezers; and five ¼ h. p. to the well known Otis Bro's. Elevator Co., to run in connection with their new pump. Four 3 h. p. motors, each driving a 48-inch fan in the Stock Exchange Building; two 1 h. p. and several small outfits to the Madison Square Garden; one 1½ h. p. new style combination motor and organ attachment for Miss K. Drexel, 103 Madison avenue; one 2 h. p. and several smaller sizes to Mr. F. S. Blackall, 239 Broadway; one each ½, ¼ and ⅙ h. p. fan outfits to the Irving bank, corner of Warren and Greenwich streets; one 2 h. p. running printing press for the *Jewelers' Review*, 58 Maiden Lane. They have also furnished one 3 h. p. motor for Prof. Browning's Industrial Institute, West 55th street; two 1 h. p. motors in Dennett's restaurant at 140 East 14th street; one 3 h. p., one 2 h. p. and two 1 h. p. at Dennett's new restaurant, 25 Park Row; also one 1 h. p. combination triplex pump with automatic tank switch, and a dumb waiter operated by 1 h. p. motor at same place.

The Chicago Car Heating Co., who are handling the Duplex Car Heater, are meeting with phenomenal success. They report that, although their advertising matter was not mailed until Thursday, the 5th inst., they have already received by mail, orders for over 210 heaters from various parts of the country. This demonstrates that the public know a good thing when they see it.

The Prior Insulating Joint, which has been illustrated and described in our columns, is forcing its way ahead in fine style. Orders are being received daily from all parts of the country by the inventor and manufacturer, Matthew Prior, Waterman, Mass.

A heavy consignment of W. S. Hill's efficient electrical switches, cut-outs, etc., has just been made from his Boston factory to a town on the Gulf of Finland. When repeated orders come for their well known specialties from so remote a corner of the globe, it is clear proof that their merits are fully appreciated.

The "C. & C." Electric Motor Company, New York, are installing a 100-light dynamo for Mrs. Mary Jacobshagen, Union Sugar Plantation; one 100-light for John T. Moore, Shriver, La.; two 600-light and one 300-light in the Erie County Savings Bank Building, Buffalo, N. Y.; one 200-light for John D. Muller, Brooklyn, N. Y.; one 100-light for the Crescent Farm Planting Association, La.; one 125-light for Shaffer Brothers, Ardoyne Sugar Plantation, La.; one 125-light for Messrs. Walbridge & Co., Buffalo, N. Y.; one 100-light for the Magnolia Plantation, La.

Mr. Albion Chipman, treasurer and manager of the Gould Packing Company, East Cambridge, Mass., reports business improving so constantly that he contemplates the enlargement of his plant.

ELECTRICAL PATENT RECORD.

Letters Patent Issued Nov. 3, 1891.

DYNAMOS AND MOTORS.

462,228. Speed Regulator for Motors. Edward H. Amet, Chicago, Ill. Application filed Jan. 28, 1891.

462,237. Electric Lighting System. Joseph I. Conklin, Brooklyn, N. Y. Application filed Feb. 9, 1891.

462,311. System of Electric Lighting. Frank M. Garland, New Haven, Conn. Assignor of two-thirds to Nicholas W. Hubinger and Joseph E. Hubinger. Application filed Sept. 9, 1890.

462,315. Electric Wire Support Bracket. Osborn B. Hall Malden, Mass. Application filed Aug. 6, 1891.

462,348. Gearing for Electro-Magnetic Motors. Chas. E. Chinnock, Brooklyn, N. Y. Application filed Aug. 26, 1890

462,333. Electric Switch. Maurice Hopes, West Chester, Pa. Application filed Aug. 4, 1891.

462,369. Controlling Device for Electric Motors. Francis O. Blackwell, New York. Assignor to the Thomson-Houston Electric Co. Application filed July 13, 1889.

462,407. Electric Switch. Rudolph M. Hunter, Philadelphia, assignor to Thomson-Houston Electric Co. Application filed May 22, 1891.

462,418. Method of and Apparatus for Electrical Conversion and Distribution. Nikola Tesla, New York. Application filed Feb. 4, 1891.

462,444. Electric Lighting Apparatus. Harrison B. Meech, Chicago, Ill. Application filed Nov. 24, 1890.

462,389. Conductor for Three Wire System. Edward H. Johnson, New York. Application filed Sept. 2, 1891.

LAMPS AND ACCESSORIES.

462,338. Incandescent Lamp. Elihu Thomson, Lynn, Mass., assignor to Thomson-Houston Electric Co. Application filed Dec. 27, 1886.

462,339. Incandescent Lamp. Elihu Thomson, Lynn, Mass., assignor to Thomson-Houston Electric Co. Application filed March 12, 1887.

462,477. Covering for the Bulbs or Globes of Electric Lamps. Alexander Duval and Henri Nelson, Paris, France. Application filed May 13, 1890.

462,540. Incandescent Electric Lamp. Thomas A. Edison, Llewellyn Park, N. J. Application filed March 25, 1891.

462,571. Electric Lamp Cover and Switch. Emil T. Mueller, Lacrosse, Wis. Application filed April, 30, 1891.

462,574. Key Socket for Double Filament Incandescent Lamp. Wm. J. McCutcheon, Jr., Pittsburgh, Pa. Application filed June 18, 1891.

462,624. Electric Arc Lamp. Thos. Conroy, Kansas City, Mo., assignor of two-thirds to Albert W. Dold and Lewis P. Tuhrman. Application filed Feb. 16, 1891.

462,660. Electric Arc Lamp. Fred H. Carpenter, Boston, Mass., assignor to the Russell Electric Co. Application filed May 1, 1891.

462,661. Electric Arc Lamp. Fred H. Carpenter, Boston, Mass., assignor to the Russell Electric Co. Application filed May 7, 1891.

462,662. Carbon Holder for Electric Arc Lamp. Henry E. Chapman, Melrose Highland, assignor to Russell Electric Co. Application filed May 1, 1891.

462,663. Pencil Carbon Holder for Arc Lamps. Henry E. Chapman, Melrose Highland, assignor to Russell Electric Co. Application filed May 7, 1891.

462,669. Stay for Suspended Electric Lights. Fred A. Johnson, assignor of one-half to Francis W. Weeks. Application filed July 21, 1888.

462,673. Electric Arc Lamp. Edwin C. Russell, Boston, Mass., assignor to Russell Electric Co. Application filed May 21, 1891.

462,677. Incandescent Lamp Socket. Thos. J. Tay, New York, assignor to Maine Electric Improvement Co. Application filed Jan. 22, 1891.

ELECTRIC RAILWAYS AND ACCESSORIES.

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462,359. Clamp for Trolley Wires. Chas. A. Lieb, New York. Application filed July 28, 1891.

462,578. Trolley for Electric Cars. Robt. D. Nuttall, Allegheny, Pa. Application filed June 19, 1891.

462,595. Electric Railway. James B. Sheldon and Daniel F. Murnane, St. Louis, Mo., assignors to the Underground Electric Traction Co. Application filed Feb. 12, 1891.

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462,262. Laminated Die, Hammer, etc., for Electric Metal Working Apparatus. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Co. Application filed Feb. 24, 1891.

462,263. Method of and Apparatus for Electric Welding. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Co. Application filed March 30, 1891.

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462,449. Secondary Battery. John H. Palmer, Boston. Mass. Application filed Jan. 3, 1891.

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462,321. Electro-Magnetic Separator. Richard Maffel. New York, and Sylvester Chichester, Brooklyn, N. Y. Application filed Jan. 20, 1891.

462,322. Electro-Magnetic Separator. Richard Maffel. New York, and Sylvester Chichester, Brooklyn, N. Y. Application filed Feb. 2, 1891.

462,345. Electric Signaling System. Frank B. Wood, New York, assignor to Brewer & Smith Visual Signal Co. New Haven, Conn. Application filed Jan. 6, 1890.

462,344. Ceiling Block. Arel Ekstrom, Lynn, Mass., assignor to Thomson-Houston Electric Co. Application filed May 26, 1891.

462,381. Electric Alarm Bell. Chas. A. Hale, Cleveland. Ohio, assignor to the Time Electric Co. Application filed June 5, 1891.

462,403. Electric Gate. Harleigh Gillette, Highland Park. Ill. Application filed Dec. 10, 1890.

462,452. Electric Fuse Cut Out. Edwin W. Rice, Jr., Lynn. Mass., assignor to the Thomson-Houston Electric Co. Application filed Oct. 18, 1890.

462,463. Switch and Cut Out Device. Henry P. Ball. Brooklyn, N. Y., assignor to the Edison General Electric Co. Application filed March 23, 1891.

462,506. Electric Current Meter. Johan W. Th. Olan, New York, assignor of one-half to Edward H. Johnson. Application filed April 16, 1891.

462,513. Automatic Signal Apparatus. Joseph B. Stewart. Haverstraw, assignor of one-half to Wm. G. Wattson. Tappan, N. Y. Application filed Dec. 23, 1890.

462,527. Electric Elevator. Harry H. Blades and Wm. J. McKee. Detroit, Mich. Application filed Jan. 11, 1890.

462,532. Electric Cooking Stone. John V. Capek, New York. Application filed Dec. 15, 1890.

462,564. Cross Tree for Suspended Electric Wires. Jacob Levy, Shreveport, La. Application filed Aug. 7, 1891.

ELECTRICITY.

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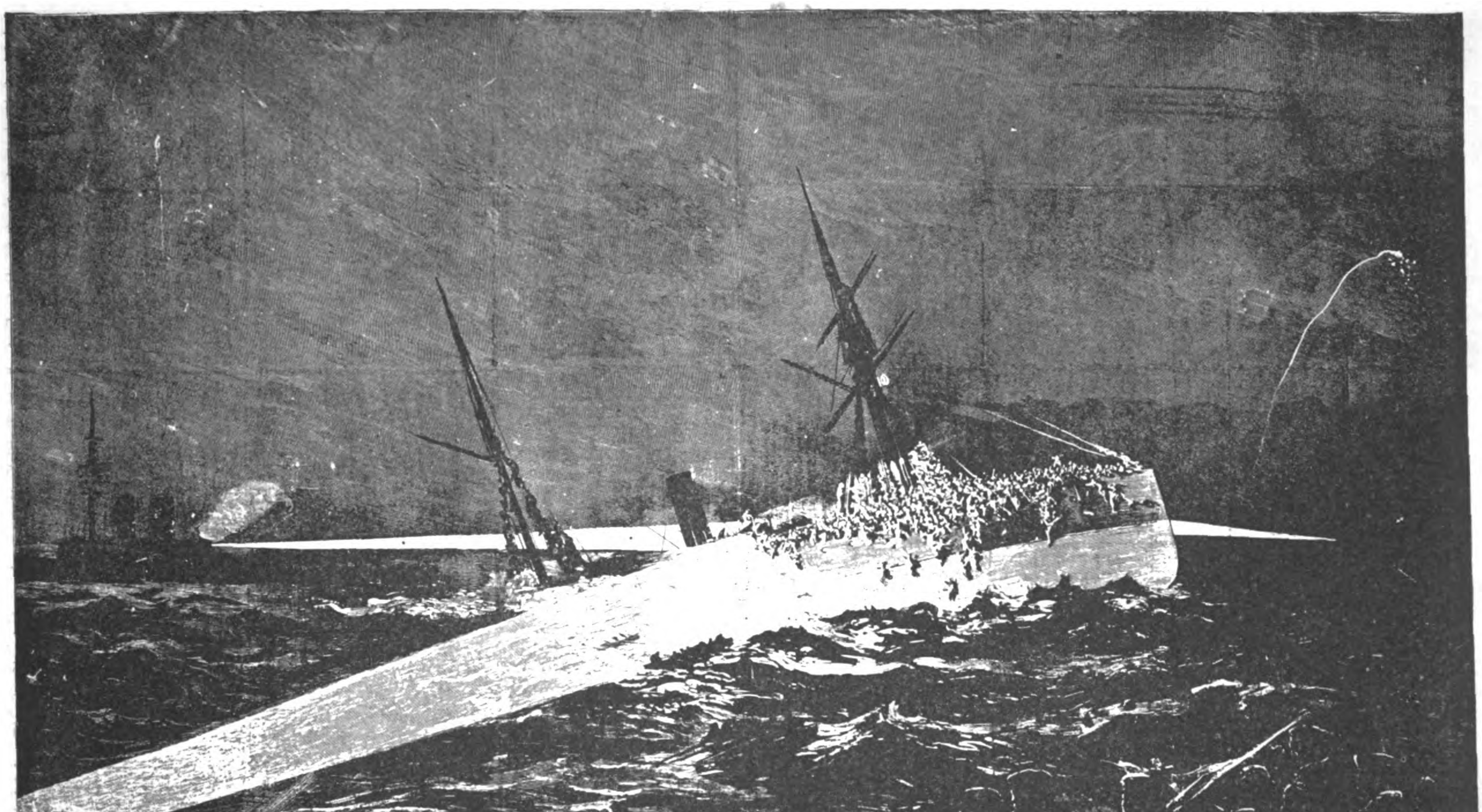


USE OF THE SEARCH LIGHT AT A SHIPWRECK.

(*See page 228.*)

THE SEARCH LIGHT AT A SHIPWRECK.

The newspapers last week have teemed with accounts of shipwrecks on the coasts of England and France, and dread disasters at sea periodically send thrills of horror through the minds of the newspaper reading public. Our frontispiece this week is a startling representation of a terrible maritime catastrophe which occurred early this year in Gibraltar Bay. The steamer *Utopia* carrying many hundreds of emigrants, in making the harbor, collided with the British warship *Anson*, and sank in a few minutes. Many lives were lost, but a great number were saved owing to the illumination of the sinking ship by the search lights of the men-of-war anchored in the bay and to the prompt assistance of their boats. This use of the search light attracted great attention and has been referred to several times in Electricity, notably in the first number, in which it formed the theme of a special illustrated article which was copied by the press throughout the country. Of course in stormy weather or in shipwrecks on rocky coasts where a vessel is quickly pounded to pieces by heavy breakers the search light can be of little value unless used from the shore, but in cases of collision or other accidents in harbor or in comparatively smooth water it is of inestimable value. Our pages have frequently borne testimony to the rapid advances made in the application of the search light, notably in the article on "Projectors" by Lieut. Hutchins, which ran through several issues of Electricity. Its adoption as part of the equipment of first-class steamships is rapidly becoming universal, and should certainly be made compulsory. Our illustration is a reproduction of a large plate which was published some time since as a supplement to the London *Graphic*.

NEW ELECTRICAL UNITS.

At the recent meeting of the British Association for the Advancement of Science, at Cardiff, one of the chief topics of discussion was the units of electrical measurement. In view of the proposed electrical Congress at the World's Fair, which now seems assured, it may be well to familiarize ourselves with the opinions held at Cardiff as to needed changes and additions, as indicating some of the subjects that will undoubtedly come up in 1893.

Dr. Oliver Lodge said that with regard to electrical units, one of the most pressing things was the determination of an authoritative statement or agreement as to the coefficient of induction, not only self induction but also mutual induction. He discussed names for new units and favored those of individuals over such as implied the character or size of the unit. In regard to the sizes of the units now in vogue, he said that the C. G. S. units were not of a reasonable size, they were a million times too big or too small. He regarded it of more importance to have the practical units of convenient size than that they should bear some simple relation among themselves. "The farad," he said "has been useless by reason of the neglect of this idea." The next unit wanted is a practical unit of magnetic field or the unit of magnetic induction." He pointed out that we already had a C. G. S. unit for this, but that it had no name and it was too small for engineering purposes.

Mr. W. H. Preece followed in somewhat the same strain. He stated that as new wants arise new names are required, and he favored the use of proper names. For the proposed unit of self induction he said that nobody had suggested a better name than that of Henry. In regard to the value of the ohm in absolute units, he favored a change from 10^8 to 10^9. He said that the former value was given to it by the original committee simply because 10^8 was the nearest approach to the Daniel cell that could be found—the Daniel cell then being universally in use in standard testing—a state of affairs that no longer existed. His chief reason for proposing the change, however, was that by making the volt equal to 10^9 it made the Farad the same in C. G. S. units as in practical units. Mr. Preece thought there was no longer a demand for a unit magnetic pole, but insisted that there were two quantities of the utmost importance in electrical developments of the present day that needed attention, viz.: permeability and specific inductive capacity. He emphasized the need of a table of specific resistances and stated that at the present time we have really only the specific resistances of mercury and copper accurately determined. He also stated that a better method of determining the mechanical equivalent of heat was imperatively demanded.

Mr. Swinburne was inclined to think it better to stick to the old units. His idea was that any change in the size of the units would result in untold confusion, and that a unit of self induction was not needed as it would not be much used in practical work. In discussing names he made a strong plea for the use of that of Poggendorf.

Dr. Johnstone Stoney also favored the retention of the ohm intact for the same reason assigned by Mr. Swinburne. He objected, however to the smallness of the dyne and also of the erg, a unit of power only one ten millionth part of the watt, and stated that as a member of the committee who had determined these units he had proposed that the metre should be the unit of length and the kilogram of mass, which if adopted would have led to convenient dynamical units.

Prof. T. H. Blakesley suggested the need of another new unit, "it was that," he said "which was measured when a current was sent through one coil of a dynamometer and another current through the other." He thought it most important to arrive at the power per unit of resistance. He was averse to giving the names of people, however eminent they might be, to units.

Prof. Andrew Gray thought the phrase "electromotive force" unfortunate as tending towards confusion, but admitted that to drop it would lead to equal confusion in another way. He thought, however, that a clear distinction should be made between electromotive force at a point, and the electromotive force round a circuit. The term should not be used indifferently in both senses. He also made the point that the production of a reliable table of coefficients of induction was of more importance than the finding of a name for the unit of inductance.

SPIRIT OF THE FOREIGN ELECTRICAL PRESS.

A new lamp whose projectors are enthusiastic enough about to hint rather broadly that is to be a rival of the electric light is described in the French papers. "A small ribbon of platinum foil, rolled upon itself in the form of a cylinder and enclosed in a receptacle of the same material is provided. A gaseous mixture consisting of air and vapors of certain hydrocarbons is slowly urged through the apparatus and ignited, with the result that the platinum ribbon becomes incandescent." This incandescence is maintained by continuing the current of mixed gases, and, as the story goes, it "rivals in brilliancy that of the electric glow lamp."

We do not know how seriously this plan is proposed, but lest some of our readers might be misled by such claims it may be well to call attention to a few facts. In the first place early experiments with incandescent electric lamps proved that platinum, to give the same brilliancy as the carbon as now used, must be heated to a degree so near its melting point as to cause a rapid change in its molecular structure, which soon causes it to break down. In the second place, this phenomenon of maintenance of an incandescent state by an atmosphere containing hydrogen or hydrocarbon gases has long been well known and was employed by Sir Humphrey Davy to maintain light in his safety lamp after the flame had been extinguished. It is equally well known that a brilliant incandescence cannot be obtained in this way, and, lastly, were there no other difficulties in the way, where is all the platinum to come from? This metal is getting so scarce that alarmists have claimed that the total world's supply would soon give out, and it is so expensive that while but a few grains only are now used in each electric lamp, manufacturers are constantly striving to still further reduce even this quantity.

There was exhibited at the Frankfort exposition a new thermo-electric battery by Gülcher which is an improvement on both the Noe and Clamond batteries. Some enthusiastic writer proclaimed that the days of the primary battery and even the dynamo were about passed, and that soon we would get our electricity direct from combustion of fuel either by means of the Gülcher battery or some improvement based on it. An enthusiastic article on this subject appeared in one of the foreign electrical journals and formed the basis for many other similar articles which appeared elsewhere.

A reaction has since set in and an interesting article on this subject, showing the absurdity of any such claims, appeared in the London *Electrical Review* for Oct. 9th. It says that the element of the large model of the Gülcher battery consumes 200 litres of gas per hour, and has an electromotive force of 4 volts. That through an external resistance equal to its own internal resistance, it produces a current of 5 amperes—a total of 20 watts and an *available* power of 10 watts. This gives a consumption equal to 20 litres per watt hour, or 20 cubic metres per available kilowatt hour. The article goes on to state that a good gas engine, driving a dynamo producing the same results, would consume but one-fifteenth as much gas. As to the improbability of a thermoelectric battery ever supplanting the dynamo, it states that "A thermo-electric battery always consuming the same quantity of fuel, whether the circuit is open or closed, should naturally always work under conditions of maximum effective power; the electric rendering is therefore only 50 per cent. and the difference of potential at the terminals only half the electromotive force. We can therefore only utilize half the electromotive force, and the battery of 10 amperes and 80 volts (Gülcher) really produces only 400 effective watts, not 800."

An interesting article on "Practical Photometric Research" by Ralph Conrad Richards is now issuing in this same journal. It is continued from week to week and trea ts the subject at such length that it cannot be epitomized here. It is, however, worth following by those interested in this subject.

Mr. B. S. Giles presents in the London *Electrical Engineer* for Oct. 9, a very exhaustive and well written resumé of the "Recent Progress in the Science of Magnetism." This is the paper which gained the prize in the Owens College Physical Laboratory. It contains nothing new, of course, since the subject does not permit of it, but its merit lies in the fact that it is well written and covers in a small space a very large and important subject.

It is a fact that cannot but be gratifying to American electricians and the public as well, that for some time nearly all the leading articles in the English electrical journals have been by American authors. That these are reprints of papers read before the National Electric Light Convention at Montreal, and not contributed directly, does not detract from the satisfaction their production in that quarter gives.

PICTORIAL TELEGRAPHY.

The advent of the telephone, which enabled us not only to converse through hundreds of miles of wire, but to recognize the voices of our friends and the report of a few years ago that one's autograph could be faithfully reproduced at the distant end of a line (now an accomplished fact) set us all to wondering if the time would not come when we should see by electricity. On account of the subtlety of the light vibrations, compared with which those of sound are crude, it seems exceedingly improbable that the latter will ever be accomplished. But there has recently been invented a process by which photographs can be transmitted to any distance and reproduced at the further end in the form of half tones, similar to the photographic reproductions so much used in illustrated journals. This process is the invention of Mr. N. S. Amstutz of Cleveland, O., and is known as The Electro Artograph.

The process is founded on the use of undulatory or varying currents of electricity somewhat on the principle of the telephone—the transmitting instrument being actuated indirectly by the varying degrees of light instead of by sound waves as with the telephone transmitter. To send a view or a portrait it is photographed on what is known as a "stripping film," composed of gelatine and bichromate of potassium. This mixture, as is well known, is sensitive to light, becoming exceedingly hard and insoluble where exposed, but readily dissolved where shielded from the light. A picture having been taken on a film of this kind, either by exposure in a camera, or preferably by printing through a negative, it is carefully washed with lukewarm water, which removes the portions not acted on by light and leaves the other portions in relief. So far there is nothing new in this process, which has long been used for newspaper work, and forms no part of Mr. Amstutz's invention. By this operation the amount of relief is in exact proportion to the light which has acted upon the gelatine, and there is produced a variable surface representing in elevation all the variations of light and shade of the picture.

This film is now stripped from the glass plate and mounted upon a sheet of celluloid which is wrapped around a perfectly true cylinder, mounted on trunnions so as to permit of revolution. In front of the cylinder is placed a bar upon which rides a carriage containing a tracing point which bears lightly upon the gelatine print just as does the stylus of the phonograph upon the wax cylinder. In the latter the needle trips over the indentations produced in the wax by sound waves and reproduces them in kind. In the former it rises and falls according to the greater or less relief due to the varying degree of light to which the film has been exposed, and by so doing varies in a corresponding degree the intensity of the electric current which actuates the receiving instrument. Thus far the analogy is very close to a telephonic transmitter, actuated mechanically by the diaphragm of a phonograph. It is clear that if this current can be caused to vary exactly as the elevations over which the stylus passes, the varying strength of the current at the distant point, if plotted, would be an exact fac-simile of the path described by the needle, or as engineers would say, it would reproduce the profile of the path originally described. Now a single line does not make a picture, although it may form one element of a picture, as it does in this case. To transmit the picture, therefore, the whole of the gelatine film is gone over, the stylus describing a spiral around the cylinder with its returning paths quite close together, just as the phonograph stylus describes a spiral from end to end of the wax cylinder, and this is accomplished in exactly the same way.

Now if the carbon button which permits of sufficient variation in current for the transmission of speech permitted of sufficient variation for this purpose, there would probably be no better way of varying the current than by its use, but carbon has not this flexibility and Mr. Amstutz had recourse to another method. The "tracer," as he calls his stylus, is mounted upon a lever which largely multiplies its up and down movement. This engages with a series of levers mounted on a common shaft, the further ends of these levers being platinum pointed and serving, when depressed, to connect the source of current with the line wire. The current enters the machine through this common, or tappet shaft, as it is called, and passes to line through the one or more contact points that happen to be depressed into contact with a plate connected with the line wire.

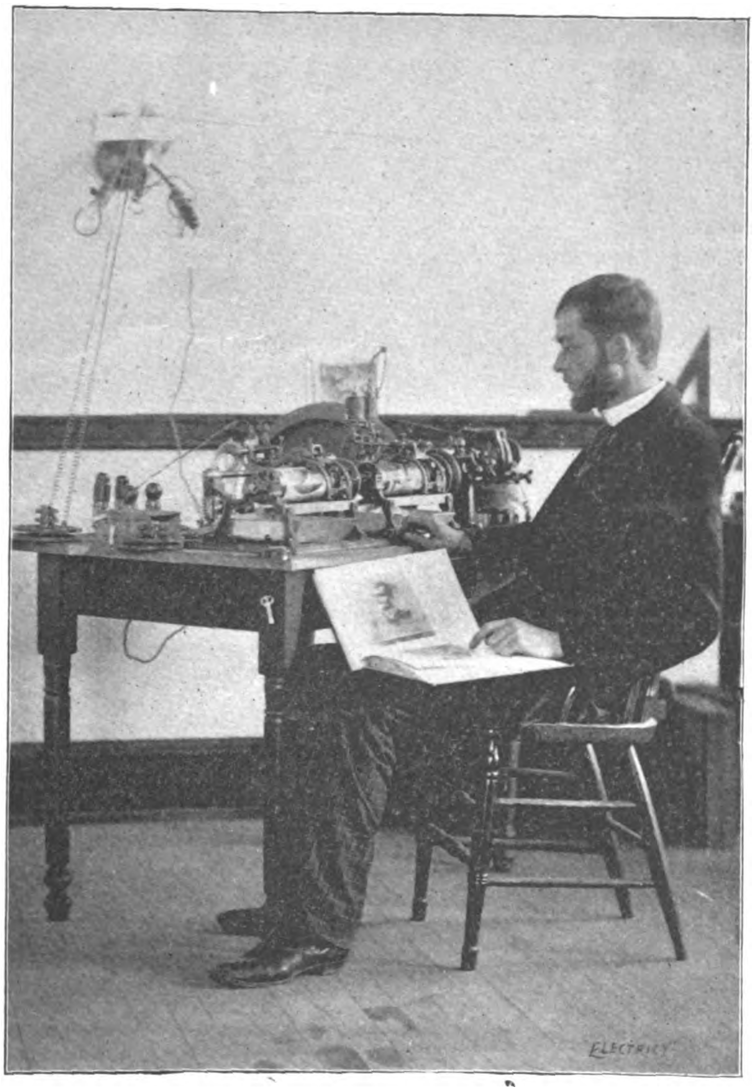
The action is this: Supposing the tracer were on a point of highest relief, only one of these levers would be depressed and the current would have but a single contact to pass through. Supposing now the tracer came across a place with slightly less relief, a second lever would be depressed, decreasing the resistance and permitting more current to pass, and so on until on passing a point of lowest elevation on the gelatine print, all of the levers would be depressed, reducing the resistance to the minimum and permitting the maximum current to pass. Of course the more of these levers there are, the more gradual the variation of current strength sent over the line. The number of these levers or tappets is not limited, but may be anywhere from two to fifteen or twenty, or more, according to the character of the work to be done. The larger the number, the greater the accuracy of the reproduction. For long distance transmission, especially for newspaper work, a large number of tappets is not desirable, since the degree of delicacy obtained thereby would certainly be lost on the rough paper and in the rapid press work to which it would be subjected; for all practical purposes a less number of tappets would produce equal results in this kind of work. Furthermore the adjustment of the sending machine to the varying thicknesses of different gelatine prints does not affect in any manner the receiving machines, so that a picture sent with great delicacy may be received in the newspaper office in sufficiently crude form for its purposes, whereas another machine connected with the same wire and receiving the picture at the same time could reproduce it with the same delicacy with which it was sent—all depending upon the adjustment of the receiving instrument.

Pictorial Telegraphy—Fig. 1.

Reduction of Fig. 1, Made After Transmission.

The receiving machines are duplicates of the

sending machines as far as the cylinder, the carriage, feed, etc., are concerned—the only difference being the graving arm, which is depressed by an electro magnet whose strength varies as the current by which it is excited. It is clear that when the transmitting instrument is passing over a low place in the gelatine film, and all the contacts are down. permitting the maximum current to pass, the electro-magnet of the receiving instrument will be at its maximum strength and the graving tool correspondingly pressed on the receiving matrix, and vice versa. The receiving cylinder is wrapped with paper covered with a suitable thickness of hard wax. This wax is turned off by a turning tool preparatory to use, just as is the cylinder of the phonograph, and when the impression is complete the waxed paper cylinder is removed, cut longitudinally and rolled out flat, and is ready for the electrotypers.



THE ELECTRO ARTOGRAPH.

As an illustration of the manner in which a picture is received, let us assume an hypothetical case. Suppose the wax used to be white and we color its surface black. Suppose the cylinder to be started and the graving tool but slightly depressed. A very delicate white line with slight depth, will be traced. If the same pressure be maintained for several revolutions, there will appear a series of delicate white lines running closely parallel to each other. Now suppose the tracer on transmitting instrument to be passing over a portion of the gelatine print of greater depth, more current would be transmitted and the triangular shaped graving tool would cut deeper into the wax, the white line would be broadened and the intervening black line made correspondingly narrower. A step further; when the tracer is passing over those portions of the film that are not intended to print at all, the graving tool will be buried so deeply in the wax as to cut away the black entirely, and in the electrotype made from this matrix this portion would be entirely cut away so as not to print at all, thus producing in metal a line fac-simile of the gelatine relief from which it was originally produced. Thus it is seen that by variations in pressure of the graving tool, all the gradations of light and shade found in the picture on the transmitting instrument may be faithfully reproduced on the receiving cylinder, and then in metal by the electrotype process.

Mr. Amstutz has also succeeded in reproducing impressions in papier maché directly from the wax, so that the engraving can be directly stereotyped in the ordinary manner.

The time occupied in transmitting an ordinary column wide illustration need not exceed eight or ten minutes, and the stereotyping of the reproductions should not occupy more than a few minutes more, so that the reproduction can be placed upon the newspaper printing presses along with the press dispatches descriptive of the subject illustrated.

By a system of gears on both the transmitting and receiving instruments, it is possible to change the size of the picture at either end of the line. That is to say that a picture can be transmitted either larger, the same size, or smaller; and at the receiving end, if there be several instruments, they may each reproduce it on a different scale. Of course much greater accuracy is attained if large originals are used and they are reproduced on a smaller scale.

A single transmitting instrument is capable of actuating a large number of receivers at different points, thus the same picture may be simultaneously reproduced at a number of widely scattered news centres.

If it is desired to send hand sketches, a process has been devised by which a special artist can make his sketches "on the spot" by suitable washes, preserving all the half-tones that he may deem necessary to the correct pictorial representation, and upon the completion of the sketch it is wrapped round a transmitting cylinder, and by a simple adjustment of the tracer, the machine can be left to itself until the whole picture has been transmitted to its destination, where it is automatically reproduced, a complete line engraving.

It is claimed for this process that the depth of engravings can be increased over 100 per cent. above that reached by the deepest half-tone engravings, thus adapting the work to uses for which the latter, on account of their shallowness, are unsuited.

Besides the use of wax as a receiving substance, Mr. Amstutz says it is quite possible to engrave directly on metal; and he expects to find large application of his device for reproducing portraits, photographs and conventional designs, both singly and in multiplicate, on silver and other metal ware, principally at local points.

We have been fortunate in securing some of the very first results of the work of the Electro-Artograph which show better than the more finished productions the operation of this process. Each of these was transmitted a distance of twenty miles over a single wire with a 110 volt current. These cuts will increase in interest as the years go by and are therefore worthy of preservation. We also present a photograph showing side by side a transmitting and receiving instrument, which, together with the foregoing description, will give a very clear idea of the apparatus employed. In the album in Mr. Amstutz' lap will be seen a portrait, transmitted by his process.

PICTORIAL TELEGRAPHY FIG. 3.

The latest addition that Mr. Amstutz has made to his invention is a system using alternating currents, by which it is possible to carry on pictorial transmission over very long distances.

PICTORIAL TELEGRAPHY—FIG. 4.

WHAT IS SAID OF "ELECTRICITY."

Railroad & Engineering Journal.

The first numbers contain some excellent articles well illustrated, and the managers are evidently determined to deserve the success which we hope they will secure. The paper is very attractive in appearance, and is worthy of attention from all who are interested in electricity—and that includes a great many people now.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

At a recent meeting of the commissioners of South Park, the important question of lighting the parks and boulevards under their supervision, leading from the centre of the city to the World's Fair grounds was thoroughly discussed. President Donnersberger was authorized to decide on plans for lighting three boulevards leading to the exposition grounds, and also for thoroughly lighting Washington Park. This step is in line with the improvements suggested a few weeks ago by President Baker. The directors want all the streets and boulevards leading to Jackson Park made so attractive that people will go to the Fair in coaches and carriages rather than on railway trains. Drexel, Grand and Oakland boulevards are to blaze with electric lights, and so is Washington Park. President Donnersberger said the board probably would begin the improvements it has in view by putting in a new electric light plant at a cost of $75,000 or $100,000. This plant is to have a capacity of about 300 arc lights and will be established in or near Washington Park. Midway Plaisance, leading from Washington to Jackson Park, is to be illuminated by the World's Fair board. Estimates will soon be furnished by Mr. Sargent on the number of lights necessary to light this part of the grounds.

At a meeting of the department chiefs, convened last Wednesday, a general discussion was held in regard to the electric fountain that is to be erected in front of the Administration Building. It was decided that several electrical experts in this line of work should be engaged to design it. The fountain is to be somewhat similar to the one in Lincoln Park, but on a much grander scale.

Work on the Electricity Building has been somewhat delayed during the past week on account of the bad weather. This has been the first set-back that the contractors have experienced since operations began. It affected work on the Electricity Building more than on some of the others, as the building is not yet roofed in. The timbers for the towers have been raised as high as the second story. From the present time on, the building will rapidly assume definite shape. Six carloads of iron trusses have arrived from Pittsburgh and will be immediately raised to form the arches that are to support the roof.

The clay model of the statue of Franklin, which is to be placed over the main entrance of the Electricity Building, was finished last week. Preparations are now being made to take the plaster cast of it. The statue, when finished, will be 21 feet high. The cornice and scroll work used in decorating the Electricity Building is being turned out by the "staff" workers, very rapidly, and by the time the building is ready, this material will be immediately placed in position.

The movable sidewalk, recently illustrated and described in ELECTRICITY, has been given a thorough test during the past week, and has been found to far exceed the expectations of its promoters. After a few minor alterations have been made it will be thrown open for the use of the public. The day for the grand opening has not been definitely decided on, but it will probably be during the coming week.

A new feeder wire has been strung from the temporary power plant to a number of the buildings at the northern end of the grounds. Current is to be furnished through this wire to run the motors that are to be installed in the buildings for driving the circular saws. At present, the Electricity Building, the Manufactures and Liberal Arts Building, the Agriculture Building, Machinery Hall and the Mines and Mining Building are the only ones supplied with electric power. It is expected to equip the Transportation Building, Horticulture Hall and the United States Government Building with the same power as soon as the motors arrive, and the new circuits are completed.

Preparations are now being made to hoist all the building material, such as "staff," mortar etc., used in the construction of the buildings, by electric power. The elevators are to be arranged so that they can be used for hoisting the exhibits to the upper galleries.

The plans and specifications for the subways and conduits have been drawn up by Mr. Sargent and his assistants and are now in the hands of Chief Burnham. Bids for the construction of the subway will be received in about ten days.

The contract for a complete outfit of fire alarm apparatus, including boxes, line wire and other necessary material, was let to the Gamewell Fire Alarm Company, of New York. When completed, the plant will consist of 150 fire alarm boxes.

The Police Telegraph and Telephone Company, of Chicago, have secured the contract for furnishing the police telegraph system. The contract calls for 50 police boxes for the present, but arrangements have been made to increase the number to 150 as soon as found necessary.

The temporary electric light plant will be enlarged by the addition of another 100 kilowatt generator and two 50-light arc machines. This addition has been found necessary by the unexpected demands from the contractors for more light and power than was estimated on at first.

Insurance policies have been taken out on all the World's Fair structures as they stand at present. The insurance on the electricity building has been placed at $90,750.

Colonel R. C. Clowry, chairman of the Committee on Electricity, has been appointed a member of the Grounds and Buildings Committee, in place of Robert A. Waller, resigned.

THE HAVANA ELECTRIC LIGHT STATION.

The Havana Electric Light Station, equipped in 1889, as an experimental plant, with one Westinghouse 1,500 light incandescent dynamo and two fifty light arc machines, has recently been enlarged. A new brick building 195 by 90 feet and one story high, has been erected and in this have been placed ten engines, two Westinghouse compound condensing and eight Armington and Sims high speed engines, having a total of 1,125 h. p. Steam is furnished to these by seven boilers of 150 h. p. each. The generating plant consists of four Westinghouse 1,500 light alternating incandescent and eight 50 light arc dynamos, with one other incandescent and two arc dynamos. The entire capacity of the station is now 8,250 incandescent and 500 arc lights. It is complete in all its appointments and not surpassed in this respect by any electric light station in the United States.

CURIOUS LAMP PHENOMENA.

BY NELSON W. PERRY, E. M.

An electrical manufacturer states that he frequently notices a curious phenomenon in a 32 c.p. Bernstein lamp in his office. It is lighted from an arc circuit. If on entering his office in the dark, he places his open hand within a few inches of the lamp the latter becomes sufficiently phosphorescent to enable him to find the switchboard. The London *Electrical Engineer* suggests that it is a kindred phenomenon to Tesla's electrostatic illumination, but this explanation does not hold good, since Tesla's illumination is due to rapidly periodic currents of extremely high tension while the one in question is the result, if due to the current at all, of a non-periodic current of low potential, presumably of not more than 50 volts.

I have frequently noticed and called the attention of others to a recalescence in the carbon filament of an incandescent lamp on turning it out. It was first noticed in a lamp on a Westinghouse alternating circuit, but afterwards also seen less distinctly in a lamp on an Edison circuit. The phenomenon of recalescence is not the only one that carbon exhibits in common with iron. A few years ago, desiring some carbons for a special purpose and being unable to get them from any of the manufacturers, I was constrained to make them myself. In order to increase their conductively I subjected them to several bakings, soaking them in molasses or coal tar previous to each repetition of the operation. I noticed that after the second baking, the carbons came out with highly iridescent colors, similar in every respect to those obtained in tempering steel, and the metallic ring of the carbon, when struck, varied so uniformly with the color, that I soon learned to determine when they were sufficiently hard by the color alone, as definitely as does the blacksmith when tempering tools. Thus it would seem that carbon is capable of taking a temper just as is the case with hard steel, and exhibits the phenomenon of recalescence in the same way as does iron.

ELECTRICAL GATHERINGS IN NEW YORK.

At a joint meeting of the American Institute of Electrical Engineers and the New York Electric Club, to be held at the club, Tuesday evening, November 24th, Mr. Carl Hering will present a paper entitled "Notes on the Frankfort Electrical Exhibition," illustrated with lantern slides. Mr. Hering was chairman of the delegation of the American Institute of Electrical Engineers to the Electrical Congress, and was given every facility to thoroughly investigate all departments of the exhibition. To those who were not able to visit Frankfort, this occasion will afford the best possible opportunity for obtaining full information from an intelligent and expert observer. Through the courtesy of the officers of the Electric Club, the privileges of the house will be extended to all members and guests of the Institute who may present the usual notice of meeting issued by the secretary.

The New York Electric Club will shortly have a most interesting and important meeting. Mr. Rosewater, the well-known proprietor and editor of the Omaha *Bee*, went this year to Europe to study the various government telegraph systems there. He made a very exhaustive investigation and was the better able to do so from the fact that he is himself an old telegrapher, who made an enviable record as a member of the United States Military Telegraph Corps during the war. He is now president of the Old Timers Telegraph Association. Mr. Rosewater will bring the results of his observations before the New York Electric Club in two or three weeks' time. Mr. Rosewater, it is understood, was specially recommended to the various European governments by our own State and Post Office Departments. He is an eloquent advocate of placing the telegraphs under national control, and believes that the facts and evidence in his possession fully justify the stand he has taken on this subject. The Electric Club is fortunate in having secured such an attractive lecture, and there is reason to believe, from the signs of interest already shown, that the audience will be one of the largest and most distinguished that has ever graced the club parlors. Members of the club will receive due notice of the date.

THE SHORTEST ON RECORD.

A special meeting of the Ashtabula (Ohio) council was recently called to consider bids for the equipment of a municipal electric lighting plant. Nine bids were submitted, five of which were considered. In just twenty-two minutes from the time Mayor Moore called the meeting to order, the council adjourned, having approved of a contract with the Westinghouse Electric Mfg. Co. to install two sixty-eight light alternating arc dynamos and one 500 light incandescent dynamo.

ELECTRICITY.

POPULAR — PRACTICAL — TECHNICAL.
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Electrical Meetings. With winter fairly upon us the season for gatherings, both scientific and social, is in full swing. Our pages this week contain references to electrical meetings in all parts of the country. The American Institute of Electrical Engineers is joining forces with the Electric Club, of New York, to hear all about the Frankfort Exhibition. The Electric Club, on its own account, will shortly devote an evening to the discussion of a very interesting subject—Government Control of the Telegraph. The Thomson Scientific Club, at Lynn, is carrying on its excellent work of giving popular but most instructive scientific lectures. The Chicago Electric Club, having devoted an evening to the 1893 Electrical Congress, has devoted another to recreation. The Chicago Society of Operative Electricians is settling down to active work, and the New York Electrical Society is continuing its enlightened policy of holding meetings in actual electrical centres.

* * *

The Benefits of Discussions. It is evident that electricians in our big cities have no lack of opportunities during the winter months for gathering to discuss the questions and problems of the day, and to learn something about branches of the profession in which they are not actually engaged. These electrical meetings do splendid work, and their benefit will be even greater when lecturers become accustomed to curtail the length of their papers, so as to allow of thorough discussion. Americans, as a rule, are good talkers and quick thinkers, and discussions, in which each man relates his own experience and his own views, are often more valuable than the papers which give rise to them. Discussions, therefore, should be fostered in every possible manner, and those who would take part in them, but feel a little diffident about plunging in, should remember that "conference makes a ready man" and that while they do good to others in bringing forward the results of their experience they are also acquiring good training which cannot but be of benefit to them in their future work.

* * *

The Bell Teleph Patents. The newspapers during the last week or so have been trying to make the public believe that there is a big conspiracy on foot to secure the extension of the fundamental patents owned by the American Bell Telephone Company. It is nothing to your newspaper man that a patent cannot be extended by the Patent Office, but only by Act of Congress; the whisper is started and it is given the widest circulation, with scare headings. Of course there was not the slightest grain of truth in the rumor, and as our New York correspondent points out, it was probably started as part of a stock-jobbing scheme. No doubt the Bell Company would like to have their patents extended indefinitely, but they are about as likely to try to obtain an extension as to ask for a pension from the Government to enable them to retire from business in 1893. By sagacious and longsighted executive management the Bell Company have placed the great industry they control in such a position that the expiration of the fundamental patents will scarcely affect the greater part of their business. The public attaches far greater importance to the telephone patents which will expire in 1893 than really belongs to them.

* * *

Pictorial Telegraphy. We present this week an article of surpassing interest on the subject of the transmission of pictures of various kinds by telegraph. It is not probable that we shall ever be able to see by electricity as we now hear, but we are coming pretty close to it when we can receive a photograph of a person or an occurrence at the same time that we receive a telegraphic message containing the descriptive matter. There have been several methods devised for transmitting line drawings by wire, but most of them involve the use of more than one circuit, and none, so far as we know, are automatic; nor do any of them produce half tone effects. The illustrations which we present are not valuable from an artistic point of view, but we think that they will be better appreciated by our readers than more finished productions would be, in that they show the operation of the process better. It is not often that an inventor is willing to have his first and crudest efforts published, and thus much of historical interest is often lost to the world. The avidity with which the first attempts of great inventors are sought for in after years attests to the interest they have for the public, and we think Mr. Amstutz is wise in permitting the publication at this time of the crude reproductions of his first experiments. The article will be read with equal interest in the family circle and in the laboratory, and our readers cannot but appreciate our efforts in placing before them at this early date such a complete description of this new and important invention.

* * *

The Frankfort Electrical Congress. Mr. Carl Hering, who, with Prof. Nichols, attended the International Congress of Electricians, at Frankfort, as delegates from the American Institute of Electrical Engineers, has made his official report to the Institute. From this we judge that not much was actually accomplished, owing to the fact, as stated by Mr. Hering, that the delegates went there uninstructed and with no definite ideas as to what should be done, and there was not sufficient time at their disposal to do more than indicate the general line of work for the next Electrical Congress, which will doubtless be held in this country in 1893. So far as this was definitely decided upon, the time occupied cannot be said to have been unprofitably spent; we pointed out in an early editorial the necessity for just such preliminary action to insure the success of the proposed Electrical Congress at the World's Fair. The American representatives, however, seem to have been better prepared for action than their confreres from abroad, in that they had outlined the matters which they proposed to bring up for discussion. Some of the points suggested were the adoption of the name "henry" for the practical unit of induction, the establishment of a normal value for the resistance of copper and the adoption of a practical unit of magnetism. These suggestions, together with the proposition of M. Hospitalier, to establish a uniform international system of notation and conventional signs and symbols, were referred to a special committee, to report at the next general session. As regards the name "henry," the English members were in favor of it, and Mr. Preece announced that he had been instructed by the Royal Society to advocate its adoption. The German, French and Swiss members opposed it. For the magnetic units, the names of Gauss and Weber met with general approval, but there was disagreement as to what the numerical values should be. The matter of the normal resistance of copper did not come up at all, for want of time. Mr. Hering concludes his report by saying that "Although our propositions were not adopted, chiefly on account of lack of time, the effect of our making them has been to prepare the way for their adoption at the next Congress," and, as Electricity has persistently maintained, he states that "A congress is hardly the place to start a discussion on such matters, it is the place to finally settle a discussion which should precede it in the societies and journals of the leading nations."

* * *

The Thomson Scientific Club. This club, organized a year or two ago, at the suggestion of Prof. Elihu Thomson, of the Thomson-Houston Company, primarily in the interests of the employees at the factory at Lynn, has already caused its influence to be felt throughout the country. The original idea, we believe, was the enlightenment and education to a higher plane, of those more immediately connected with the interests of the firm, and to this end lecturers of high repute have been invited each season to discuss, in a popular way, electrical and general scientific subjects of common interest. Prof. Thomson himself set the pace in a most admirable lecture on "What is Electricity," in which he brought the information down to the latest date, illustrating in a simple and effective way the phenomena first described by Hertz, and describing many more of his own discovery. This lecture was printed in pamphlet form, and constitutes to-day the best popular exposition extant of the new direction taken in electrical research. The good that has been done could not be limited to the few for whom it was primarily intended, but has been extended to a far wider circle. So successful were the first efforts, that a new course of lectures

has been announced for the coming winter, the subjects and the names of the lecturers announced guarantee that the high standard adopted in the beginning, will be maintained in the future. This interest of employer in the education of his subordinates is one of the benign results of very recent civilization. Aside from its philanthropic aspect, it is no less important from a business point of view. Experience has shown that intelli gence, even in the humblest employee, has a distinct money value, and in proportion to his elevation, so will he do more and better work. We heartily commend to other electrical concerns the formation of clubs on the plan of the Thomson Scientific Club. We should like to see a similar move in all of our large cities. Much is being said and done in these days in university extension. We know of no way in which the greatest good could be more effectively accomplished for the greatest number by our educational institutions, than by the emulation of the work so successfully inaugurated at Lynn.

A STRANGE PROCEEDING.

The English Royal Commission, which has charge of all exhibits to the fair from Great Britain and her colonies, has just raised a very important question. It has issued a circular informing all English exhibitors that they must pay for space in the World's Fair buildings at rates ranging from 60 cents to $1.20 per square foot. In their official notice, members of the commission say that they are compelled to charge for space on account of the meagre appropriation of Her Majesty's Government. For months, Director General Davis has been sending printed matter to Europe, informing prospective exhibitors that no charge would be made for space in the buildings. When the English commissioners were in Chicago he gave them 250,000 square feet free of charge and promised to give them more, if needed. These are the rates fixed by the English commission:

	Per sq. ft.
100 square feet and less	$1 20
100 square feet and less than 200	1 08
200 square feet and less than 300	96
300 square feet and less than 500	84
500 square feet and less than 750	72
750 square feet and upward	60

The minimum charge will be $25.

Colonel Davis does not understand that the English commission has any authority to collect money from exhibitors. He is now in correspondence with Sir Henry Trueman Wood, secretary, to learn why the charge is levied. Officials of the fair believe the action of the English board will injure the exposition abroad, especially if the precedent should be followed by other countries. At the Paris exposition no charge was made for floor space, but the managers made an assessment for 'flooring," which caused much complaint.

GRANULATED IRON CORES.

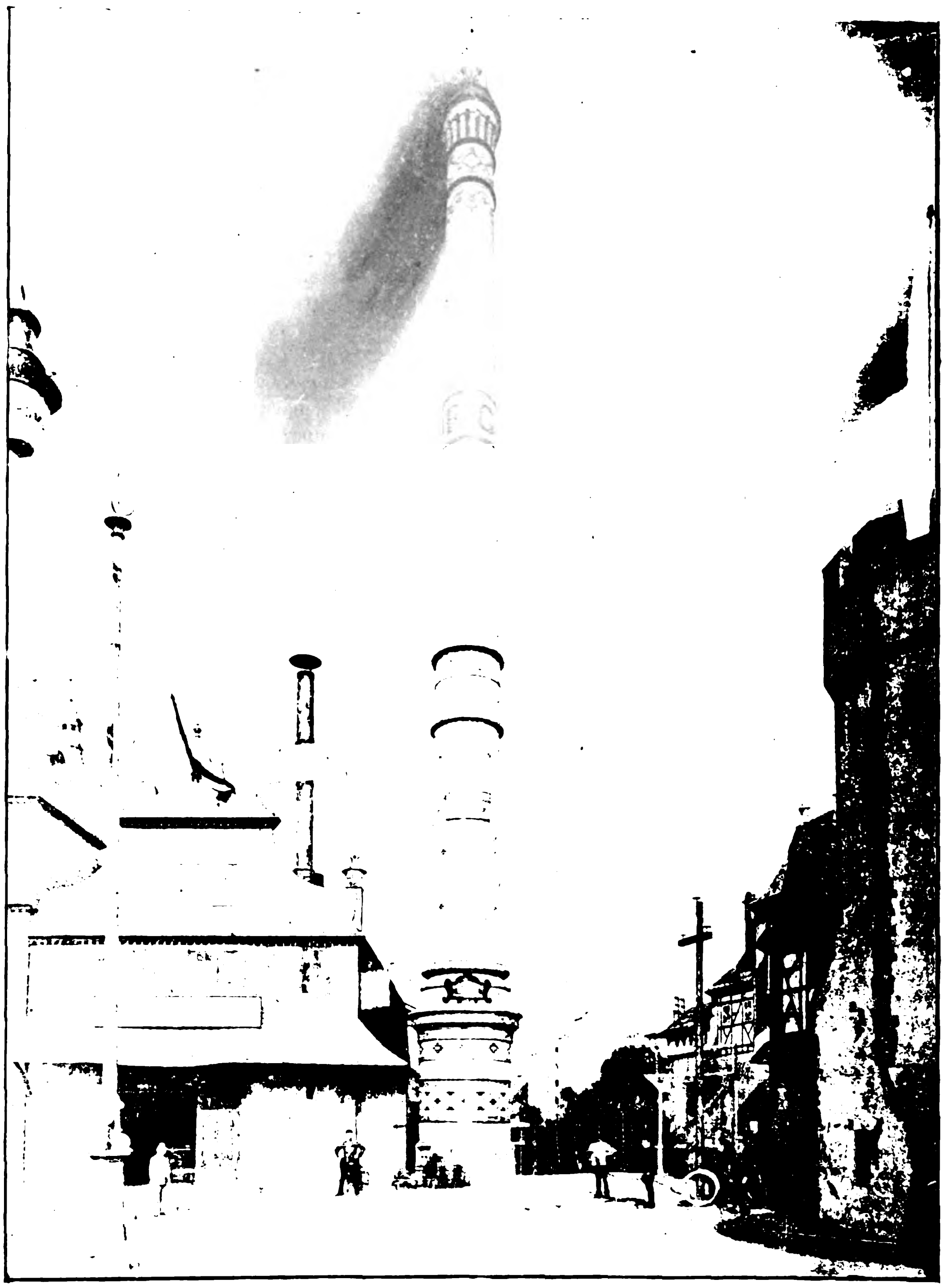
"The prevention of Foucault currents," says the London *Electrical Engineer*, "is one of the great objects of the constructing electrical engineer, and if a better method than the use of simple laminated cores could be made practicable, it is possible that the loss in that direction might be further reduced. Whether this can be done in the way advocated by Mr. S. C. Currie is for practical dynamo builders to say. The idea has probably presented itself, but we do not remember any case in which it has been actually employed. This method is to build up the cores and armatures from iron in a granulated form, such as iron filings, first oxidised or coated to prevent magnetic contact, and then compressed into a solid mass."

We print the above clipping to show how *not* to do it. Foucault currents would undoubtedly be prevented by the method advocated by Mr. S. C. Currie, but the magnetic circuit would be most effectively destroyed. We wonder that any person with practical knowledge of magnetism should suggest such a plan, or that it should be given currency by a reputable electrical journal such as our esteemed contemporary certainly is.

SUBSTITUTES FOR GUTTA PERCHA AND INDIA RUBBER.

The stringency in the gutta percha and india rubber market is serving as a stimulus to inventors and others to find a substitute for those articles which form such an important factor in nsulating compounds. Some time ago the lay press contained accounts of a most wonderful substance discovered in Texas, to which the name "litho-carbon" had been given, and for which the most remarkable insulating and other properties were claimed. It speaks well for the electrical press that it did not lend itself to the propagation of these fairy tales that formed such a choice morsel for the daily papers.

Another new substitute is announced in England, called "Blandyte," after the name of the inventor, Dr. Blandy. We do not wish to class this with "litho-carbon," but from its composition, which is said to be chiefly waste leather, we are not led to expect much from it, nor are we assured by a test which is given as conclusive proof of its insulating qualities. According to the *Electrical Engineer*, (London,) this test consisted in immersing a covered wire in sulphuric acid and water for seventy-two hours, no deflection being given with a delicate galvanometer and *ten volts*. No test for insulation means anything at all unless it be made with a high E. M. F., not less than 100 volts. In cable factories it is customary to use a battery of from 200 to 500 cells for insulation tests.



Ornamental Chimney at Frankfort.

NOTES ON THE FRANKFORT ELECTRICAL EXHIBITION.

One of the popular sources of amusement at the Frankfort Exposition and one which brought in a revenue of $5,000 to the management, was the electrical race course, a view of which is shown on page 234. The picture at once suggests the flying dutchman so popular at our county fairs, but differs from it in that the horses are not suspended but are mounted on electrically propelled trucks beneath the platform. Each truck is propelled by a two horse power motor operated by a current at 150 volts pressure. There are eight

Electrical Race Track at Frankfort.

courses having a mean length of about 280 feet. The speed attained reaches nearly ten miles per hour. As the speed on different courses may be

Electric Light Fixture at Frankfort.

varied by switches under the control of a man hidden from the view of the riders and without their knowledge, the excitement and exhilaration of a genuine horse race, the outcome of which is uncertain until the last moment, is added to the pleasure and novelty of riding a horse propelled by unseen means.

In Mr. Hornsby's report to the Director General of the World's Columbian Exposition, printed in full in our last issue, he calls especial attention to the decorative features that were so prominent at Frankfort, and in which lines the Germans have far surpassed us. In our issue for October 7th we gave a large picture showing how attractive such a homely subject as a wire exhibit could be made. On October, 4th we showed some beautiful electroliers and a very striking and graceful lamp support in the form of a female equilibrist balancing on one toe an electric lamp surrounded by a ground glass globe. In our present issue we continue the illustrations of artistic effects which cannot but be interesting and instructive and which it is to be hoped will have a beneficial effect upon the character of the exhibits at the World's Fair. One of our illustrations shows what art can do for so unattractive a structure as a smoke stack.

This picture will be a revelation to steam engineers in this country, as all attempts at artistic adornment of chimneys, have heretofore been feeble and unsuccessful. This perhaps was to be expected among such practical people as Americans, for we have been heretofore so occupied with the utilitarian that we have had little time to devote to the artistic side of life. But we are getting older and richer, and with accumulation of means are finding more time to devote to the cultivation of the beautiful. The World's Fair is to mark an important epoch in our material progress. May the lesson taught at Frankfort be so well learned that it may also mark as important a one in the more intellectual line of artistic adornment of the creations of that material progress.

HOW TO GET PAYING LOADS FOR STATIONS.*

This is an exceedingly interesting and instructive paper detailing the means adopted and recommended for obtaining paying loads for electric light and power stations. Mr. Marks indicates the difficulties encountered by station managers who came on the scene before public confidence in the electric light had been established, by the answers received to inquiries as to their present whereabouts. These answers, he says, are usually: "He is dead, "He is in the insane asylum," or "I don't know where he is, he couldn't make the station pay and resigned."

With the price of gas at $1.50 per M., which is the same as three-fourths of a cent per 16 candle lamp hour, Mr. Marks' company at first fixed their charges at 1⅛ cents per lamp hour. This made electricity an expensive luxury and the company made poor progress in obtaining customers. Later, the price was reduced to that of gas, viz. three-fourths of a cent per hour and custom rapidly increased.

He adopted a novel and effective method of advertising. While he employed but a single agent himself, he wrote to all the electrical manufacturing firms he could learn of, requesting them to establish agencies in Philadelphia, and in this way 13 wiring firms and 19 different types of motors became represented in that city by agents. To these he offered 15 cents premium for all lights secured and $1.50 per horse-power on all motors when the current was turned on. Then if he heard or thought he heard of a person who wanted light or power, he sent a card to each of the 32 agents, and as a result, he says, "before night that man had either surrendered or left town." He also had little tin flags painted red and put on the ends of pointed iron bars, and on

Electric Light Fixture at Frankfort.

these were painted "The Edison Electric Light Co. Apply for services at 906 Sansome St." In this way every ditch and line of conductors was advertised.

* By W. D. Marks, Supervising Engineer and General Manager of the Edison Electric Light Company, of Philadelphia. A paper read at the Seventh Annual Convention of the Association of Edison Illuminating Companies.

He says every form of advertising paid, but the best advertisement of all was a satisfied customer.

Power was sold to all 110 volt motors at lamp rates. For 220 volt motors, the rate was 7½ cents per horse-power-hour. If a customer took more than 1,000 horse-power-hours and less than 1,500, the price was fixed at $75 for four weeks. All power above 1,500 was sold at 5 cents per horse-power-hour.

He says that while it is certainly advantageous to supply motor service during the day time, still there are disadvantages connected with such service. That while motors running from say 7 a. m. to 6 p. m., give the station a uniform load during a time it would otherwise be nearly idle, still, in the winter time, when lighting begins at 4:30 p. m., they overlap the lighting load between 5 and 6 p. m., making, during that time, a very high maximum as compared with the average load. He suggests, as a solution of this difficulty, the employment of storage batteries. This is a plan very largely employed abroad and frequently advocated in Electricity, but has not yet obtained a foothold in this country.

He says, "All and every expense of running included, it costs us from $2.50 to $3.00 per lamp per year and we obtain a revenue of about $5.00 per year for each lamp."

"At present, on an average, all of our lights and motors are profitable to us, costing us about thirty-five one hundredths of a cent and being sold at from ½ to ¾ of a cent per lamp-hour." This gives the company an average profit of eighty-two one-hundredths of a cent per lamp per day, which places them on a moderate dividend paying basis.

Lights are sold by meter measurement, which plan Mr. Marks approves. As to the accuracy of the meters he says, that whenever errors occur, they are in favor of the consumer and against the company, and usually give entire satisfaction.

THE TENTH ANNUAL MEETING OF THE OHIO STATE STREET RAILWAY ASSOCIATION.

This association, whose meetings have always been of such interest in street railway circles, and which has heretofore always selected the larger cities of the state for its conventions, decided last year at Columbus that at the next meeting it would favor some one of the smaller progressive towns with its presence. In accordance with this decision, Akron was chosen as typical of such towns and the meeting that was convened on the 11th inst. was held there.

The opening address was delivered by President John N. Stewart, who at once got the delegates into good humor by his witty way of stating homely truths. He stated that at the last meeting he had taken the liberty of introducing an innovation by inviting gentlemen not connected with the Association to address the members on subjects that would be not only interesting but instructive.

The subject of legislation was first discussed. In regard to this he said "I much desire at this time to thoroughly impress upon you the importance of co-operation in the support of all legislation calculated to enhance the interests represented by us, as well as the importance of united defence against all 'piratical and tyrannical' measures attempted in the name of the public by some selfish and mercenary malcontent, temporarily elevated to the dignity and importance of a statesman." In this latter statement he referred to what he characterized as "attempts to make corporations bear more than a just proportion of the expenses of ADMINISTRATION OF THE STATE GOVERNMENT."

He claimed that theirs was a sacred trust, that their bonds and securities were owned by all classes of people and held in trust for minors and indigents and that upon the earnings of such investments depended the weal or woe of many a household, and that they had never proved recreant to this trust.

The word "franchise" he wished dropped from the vocabulary, as whenever it was used the public were inclined to suspect the presence of "a large sized wolf in sheep's clothing to be contained therein." He would substitute the word "contract" as being truer to the fact and less likely to carry with it objectionable and erroneous ideas, and argued that what railroads applied for, and sometimes got, *were* contracts and not franchises. The latter term, he said "affected many as does the flaunting of a red blanket in the face of an infuriated bull" and should therefore be dropped.

He paid his respects presumably to the Washington Subway Commission who recommended municipal ownership of street railways, by strongly condemning such a proposition and characterizing it as a lamentable failure wherever tried.

President Stewart's address was followed by a paper by F. G. Brownell on street cars, in which he emphasized the importance of making them comfortable, attractive and of good material. They should be neither too heavy nor too light; there is a happy medium, he said, which gave the best net results. In regard to the means provided for getting in and out of the cars he said that it was not unreasonable to assume that "in a round trip of seventy-five minutes, at least twenty are devoted to stops; what does this mean in wages to a car making fifteen trips per day? A reasonable calculation gives us 300 minutes or five hours per day for conductors and drivers which at twenty cents per hour each, would make $2.00 per day or $730 per year. Now if this lost time could be reduced one-half, the company would be the richer by $365 per year per car, which is six per cent. on $6,000." The rest of the paper was chiefly devoted to advice as to the care of cars and how to buy them, and will prove of more interest to street railway operators than to electricians.

THE CHICAGO SOCIETY OF OPERATIVE ELECTRICIANS.

The Chicago Amateur Electrical Society has decided to change its name to "The Chicago Society of Operative Electricians." The objects of this society are the advancement of its members in the knowledge of electrical science, by lectures to be given by prominent electricians interested in the society, and by a thorough course of study, using standard works under the supervision of an instructor. Mr. H. G. Brownell, a college graduate of several years practical experience, has been chosen for this position. As soon as the finances of the Society will permit, a library will be started, in connection with which a laboratory will be fitted up in order that theory may be demonstrated by practical experiment, a manner of study which has been adopted by our best colleges and manual training schools.

Another feature of the society will be an amateur electrical display at the World's Fair. Mr. J. Allen Hornsby, Secretary of the electrical department of the Columbian Exposition, in an address to the society, stated that the department would endeavor to secure for it, in all departments that could possibly come in its sphere, the same honors given the professionals. He also promised that heat, light and power, would be furnished for the exhibit. A committee has been appointed to make arrangements for an exhibition, and is already hard at work.

Considerable interest in the society is manifested by young men engaged in electrical work, and a large membership will soon be secured. The regular meetings are held the first and third Thursdays of each month. On Monday evenings the members meet for informal study and discussions.

It is earnestly requested that all young men engaged in the study of electricity will take an interest in the work of the society, and that similar societies and experimental clubs will correspond and co-operate with this society in its endeavor to make a creditable amateur electrical display at the World's Fair. The next meeting will be held Thursday evening, November 19th. Mr. Pumpelly, of storage battery fame, will deliver an address, and interesting papers on other subjects will be read. Working electricians of Chicago are earnestly requested to be present.

All communications should be addressed to the Corresponding Secretary, S. G. Arnold, Room 5, 120 Quincy Street, Chicago.

LEGAL NOTES.

On January 12, 1891, the United States Circuit Court, Northern District of Illinois, granted to the Western Electric Company an injunction against the Electrical Construction Company and Gustav A. Harter against using annunciators on passenger elevators whereby signals are given from each floor by means of a signal key, which connects with a flexible electric cable attached to the cab; or with a vertical metal strip or wire extending from the bottom to the top of the elevator well. The injunction was granted on the ground that such use was an infringement of patents owned by the plaintiffs. One of these patents, that granted to Gray, Feb. 1, 1876, still has some time to run. This patent covers "The combination of a movable elevator car, the annunciator attached thereto and moving therewith, circuit closing and breaking signal keys on different floors, and mechanism whereby an electric current is maintained between the signal keys and annunciator without interruption by the movement of the car."

Notwithstanding the injunction, the defendants, in May last, put in an elevator in the Haymarket theatre embodying the device patented by Gray—hence the suit.

Decision: "The defendant has violated the injunction and thereby is guilty of contempt of the order of the court."

Fine, $60 and costs.

Barton & Brown, for complainant. Opinion rendered Nov. 9, 1891.

J. H. Whipple, for defendants.

The Electric Gas Lighting Company of Boston, a corporation chartered under the laws of the State of Maine, filed a Bill in Equity on Monday, the 9th inst., in the U. S. Circuit Court for the Eastern District of Pennsylvania against John Y. Parke, of Philadelphia, to restrain him from manufacturing certain electric gas lighting devices which it alleges infringe Letters Patent, No. 225,071, issued March 2d, 1880, to Henry F. Packard, now owned by the Electric Gas Lighting Co. In the Packard burner the gas is lighted by an electric spark produced by making and breaking contact of two electrodes; the gas is turned on by pressing or pulling down and then releasing a lever fitted loosely to the stem of the cock, which causes a vibratory arm to sweep past the tip of the burner and make and break contact between two electric points; by this means the spark is produced which ignites the gas. The Packard patent is alleged to be the first granted for this class of burner and has been before sustained by the U. S. Courts in infringement suits in which it was involved. An injunction and account is asked for by the complainant.

ELECTRIC WELDING.

General Manager Royce, of the Thomson Electric Welding Co. in speaking of his company's affairs two days ago, said; "The company is in splendid condition financially and does not owe a dollar. The last installment of 25 per cent. of

$500,000 of stock recently issued, increasing the capital stock to $1,000,000, has not been called, and will not be called until it is for the purpose of allowing the company to pay dividends." Of the 10,000 shares of stock issued, the company has in the treasury 398 shares and 165 stockholders own the balance of the stock, most of whom are investment holders.

Mr. Royce estimates that the gross business from Jan. 1 to date has amounted to over $150,-000, which will show a handsome net-profit. The business increases daily, and since July 1 amounts to about $80,000 gross.

Within 18 months the Johnson Co. of Johnstown, Pa., has purchased $46,000 worth of welding machines and has expended $60,000 in boilers and plants for the machines. All contracts are for cash payments. When the Welding Co. was organized, it purchased from Prof. Thomson about five patents and five applications, and to-day the Company has 131 patents and applications, besides several in foreign countries. The Johnson Co. recently wrote the Electric Welding Syndicate of London, that they have used one of the Thomson Electric Welding Co's. machines for general work, during the past year, and the larger proportion of the work done by this machine was of a nature that could not be done by hand welding.

A NEW ELECTRICAL SUPPLY HOUSE IN CHICAGO.

The Electric Appliance Company, Chicago's new electrical supply house, has just made its bow to the trade. The officers of the company are Willard W. Low, president, Harry B. Gilbert, vice president, Thos. I. Stacy, sec'y and treas. Mr. Low has been well known to the western electrical trade for the past eight years. Mr. Gilbert and Mr. Stacey have been identified with the electrical interests of Chicago for about five years, and are too well known to need any introduction to electrical people. The company is certainly very fortunate in having for its staff of officers gentlemen who have grown up with the trade in the West and have acquired such large practical experience. It is the intention of the company to make a careful study of the wants of the trade and to place themselves in a position to supply those wants, and not to endeavor to put on the market any article for which there is no certain demand. They have already secured the control of several well-known specialties, and expect to be in a position, before December 1st, to meet every demand that can be made upon a general electrical supply house.

The company has secured the large and well-appointed building at 242 Madison street, which will give them unexcelled facilities for carrying a large stock and making quick shipments. Their location is also in the very centre of Chicago's retail electrical supply trade, and one of the officers of the company will give this department his personal and undivided attention. Electricity joins their many friends in wishing them the fullest measure of success.

ELECTRIC LIGHT IN THE TOWN MARKET.

The new Town Market of John M. Smyth, on West Madison street, was thrown open to customers for the first time last week. The building that now occupies the site of the old structure, which was burned down last spring, is one of the finest and largest house furnishing stores in the West. The show and salesrooms on the lower floors are undoubtedly the most handsomely appointed rooms of the kind in this country. One of the features that go to make up the neat display is the liberal use of electric lights. The floor area of 332,000 square feet is to be illuminated by 3,000 incandescent and 40 arc lights. The plant, which is located in commodious quarters in the basement, consists, at present, of two Edison incandescent dynamos of 20 and 30 kilowatts each, and one 40-light arc dynamo of the Edison-Sperry pattern. These machines are belted to two 150 h. p. New York Safety engines. The plant was installed by the Chicago Edison Co. Mr. A. J. Cliff has been placed in charge.

ANSWERS TO CORRESPONDENTS.

Subscribers to Electricity *are invited to make use of this column whenever electrical questions of general interest arise. Where apparatus is concerned, full details should be given. It will be the aim of* Electricity *to answer all legitimate queries of an electrical nature in as clear and untechnical a manner as possible, and thus to make this column a friendly guide to those of its readers who may desire such assistance. Inquiries should be accompanied by the full name of the writer—not necessarily for publication, but for our own information—and should be addressed to the Editor of* Electricity.

Will you please inform me what kind of batteries to use that can be concealed about the person, and give an E.M.F. of about 4 volts; also, how a photometer scale is graduated?

F. H. B. Boston.

There is no cell that gives an E.M.F. of 4 volts. It would be necessary, therefore, to use several. For concealment about the person a dry battery is preferable, as there is then no danger of spoiling the clothes by spilling liquids. There are several good dry batteries on the market, which usually give an E.M.F. of about one and a quarter volts when new. To obtain the required potential, therefore, four of these would have to be used in series. A couple of miniature storage batteries, properly secured in hard rubber cells, would perhaps answer your purpose just as well.

As to the graduation on photometer scales, the unit is arbitrary, the only essential being that the divisions be sufficiently small for the accuracy desired, and that they be absolutely equal.

While as stated above it is immaterial what the unit of graduation is, still there are methods that simplify the calculation of results—one of the best of these which enables one to read the candle power directly, was described in Electricity for August 26, 1891, page 69.

Can you tell me whether or not experiments have ever been made or has it ever been proposed to run electric cars by means of an induced current, *i. e.*, with wire or wires from generator carried in a conduit between the tracks, and a coil or coils of wire underneath the car in close proximity to the wires—car motors probably of the alternate current type? What is the probability of the success of such a plan? F. R. C. Ware, Mass.

We are not aware that any such experiments have ever been tried; but the suggestion has been made often enough. It is not probable that any such plan could succeed, unless the conductors within the conduit were formed into a series of coils, which would make the cost both of installation and operation prohibitive. The induction from a single wire, however powerful the current, would be so feeble, comparatively speaking, as to render that method entirely out of the question. Then, too, the inductive effects of a single wire decrease as the square of the distance, so that what little there was near the wire would be greatly diminished at the closest distance to which the car coils could be brought. The use of two wires—outgoing and return—in the conduit would practically destroy all inductive effect, as they would nullify each other.

A SEVERE TEST OF AN INSULATED WIRE.

In the manufacture of insulated wire it is usual to make them of different grades to meet the special requirements of the uses to which they are to be put. A manufacturer in warranting a given wire or cable usually does so only for the special purpose for which it was intended. It is a fact, however, that wires made and bought for a given application are often used for entirely different duty, and if they break down under such use the manufacturer is blamed for having supplied an inferior article. That they do often give satisfaction under such conditions speaks volumes for the high state of the art of insulation.

A peculiarly aggravated case of the misuse of an insulated wire, in which it managed to give satisfaction, nevertheless, comes to us from Utah. Mr. George Cutter recently sent a lot of Simplex braided rubber wire to that section of country for indoor wiring. After its arrival it was desirable to do some blasting under 600 feet of water in the Anchor Mine, at Park City, and the man in charge, either knowing no better or else having exceeding confidence in this make of wire, employed it to set off the blast. It stood the test perfectly and the company handling the Simplex wire are correspondingly elated and consider that a new feather has been stuck in their cap.

PROF. ELIHU THOMSON ON THE CONVERTIBILITY OF ENERGY.

The first lecture of the season at the Thomson Scientific Club on the Convertibility of Energy, was delivered by Prof. Thomson on the 4th inst. In a previous lecture he had shown that light was due to a rapidly vibratory motion caused by electrical, chemical or mechanical means. In this lecture, continuing in the same line, he showed that to the same cause were due also the phenomena of heat and sound, and that vibratory motion was the underlying principle of all mechanical and chemical changes. These facts were illustrated by the striking of a match. The energy imparted by the hand changed the potential energy of the tip into kinetic energy; the molecules rearranged themselves, resulting in a chemical change, producing water as one of the results of the rearrangement, which under favorable conditions would be condensed and precipitated in the form of rain, thus completing the cycle back to mechanical power again. As other results of this chemical change there were produced light, heat and sound. While electricity may not have been produced, it is a matter of common knowledge that heat can be converted into electricity, thus by this simple and homely experiment it was demonstrated that mechanical motion could be converted into all the other known forms of energy.

As an instance of highly concentrated potential energy he exhibited a drop of nitroglycerine. By means of a blow from a hammer the energy was manifested by a violent explosion.

As an illustration of the convertibility of electrical energy into other forms, a steel horse shoe, having coils wound on its limbs was magnetized by an electric current. The ends of these coils were connected with a galvanometer and on removing the armature by mechanical force, a current was again generated and heat resulted. When carried out on a large scale, as in the dynamo, sufficient heat could be generated to produce light. And thus by a series of simple and familiar experiments, he demonstrated that light, heat, sound, mechanical, chemical and electrical phenomena were all different manifestations of that same intangible, mysterious something, which we call energy, and were strictly interconvertible.

FROM NEWS CENTRES.

NEW YORK.

New York, Nov. 14.—The meetings of the various electrical bodies of the city are now in active progress. The Electric Club will shortly be addressed by Mr. Rosewater, of the *Omaha Bee*, who visited Europe this year to study the various systems of government telegraph there. The results of his European trip will be fully set forth before the Club, together with the various suggestions that have arisen out of the investigation. Among these is understood to be the placing of the telegraphs under government control in this country.

The New York Electrical Society has arranged for a meeting on Thursday evening at the Fire Headquarters, where by the kind permission of the Fire Commissioners, there will be an inspection of the equipment, which is one of the largest and best of its kind in the country. The members of the Society will thus be enabled to study the practical workings of a department, the importance of which is shown by the fact that it watches over the lives of nearly 2,000,000 of people and the safety of hundreds of millions of property.

The condition of the water supply of the city is becoming so alarming that steps are being taken to avert a water famine. The daily consumption is now 110,000,000 gallons, and even at that rate, unless heavy rain should fall, which is very unusual during the Indian summer, the supply will be restricted within a few days. Already Commissioner Gilroy has addressed a communication to the Police Commissioners, pointing out the gravity of the situation, and authorizing them to stop the use of the hose throughout the city, and to arrest all who violate the order; and the sprinkling of the public streets has also been forbidden. The effect of further scarcity of water would be most seriously felt by the majority of the industries and manufactures of the city.

Among recent incorporations is that of the Long Island City Electric Illuminating Company, which has filed its certificate with the Secretary of the State. The company, which has a capital of $50,000, is formed for the purpose of furnishing electric light for public and private purposes in Long Island City. Its directors are Edward M. Tyrrell and William A. Christian of Brooklyn, and James W. Lamb, of Long Island City.

The Board of Electrical Control is following up the recent decision in its favor, by cutting down large numbers of pole and housetop wires. The principal sufferers by the latest order of the Board, are the United States, the East River, the Mount Morris, the Western Union and the Metropolitan Telephone Companies.

The fight between the Electrical Accumulator Company and the Julien Electric Company continues, and Judge Lacombe has appointed H. R. Newbery, Charge d'Affaires of the United States Legation at Madrid, a commissioner to take evidence in the suit. At present there are no signs of the renewal of the storage battery car service on the Madison Avenue line, but it is understood that active work will be begun in the early months of next year.

Somewhat of a sensation was created here during the week by a report that the Bell Telephone patent was about to be extended for another term of seventeen years The report was promptly followed by a denial from Washington. Patent Commissioner Hall stated that nothing has been done in the Patent Office within a recent period to justify the notion that any such step is contemplated. It is believed that the rumor emanated from a stock-jobbing source, and was designed to have a favorable effect on the price of the Bell Telephone stock.

It is understood that a very determined opposition will be made in the courts to the plans of the Rapid Transit Commission by owners of property on the line of the proposed road, where it is proposed to put stations under the sidewalk. According to the plans, the station platforms will be close up to the area line, and in some cases up to the building line itself, thus cutting off all means of access to basements except from the inside of a building. It will therefore be readily understood that the securing of the consent of property owners to the running of the proposed line will be a task of no little difficulty. G. H. G.

BOSTON.

BOSTON, Nov. 14.—The Schultz Belting Co. through its eastern branch house, shipped to England one day this week for a single order, 1,000 feet double belt six to twelve inches wide, 1,500 feet single belt three to six inches wide; and about $1,100 worth of lace and belt leather. This company enjoys an increasing business with Europe, and Mr. W. P. Mullen, who has charge of the Boston house, is kept busy.

At the last meeting of the City Board of Aldermen there was a spirited debate on the subject of improved fenders or safeguards on the electric cars. The matter was brought before the directors of the West End Railway Co. and experiments have since been made with various new devices. The president, Mr. H. M. Whitney, has also written the aldermen that his company is ready and willing to adopt any new style of safeguard that minimizes the liability to accident, but at present they are doing their utmost to obviate all danger.

The people of Wakefield, Mass., have appointed a committee to present a petition to the Legislature asking for a special act to allow the town to construct an electric light plant of its own, also to ascertain on what terms the local gas company will sell the existing plant.

The Thomson Scientific Club, of Lynn, is doing splendid services for its members and for the public at large. Included in the good work being done through the Fall and Winter is a course of popular scientific lectures to be given in Odd Fellows' Hall. These lectures are mainly illustrated by experiment, and are intended to be specially interesting and instructive to those who are not actually engaged in electrical pursuits. The following is a complete list of the lectures, together with the names of the lecturers: "Convertibility of Energy," Prof. Elihu Thomson; "The Acoustic Principle Underlying the Operation of the Telephone," Prof. Charles R. Cross; "The World's Moral Capital," Dr. J. M. Pullman; "Ether, or how Energy is Transmitted Through Space," Prof. A. E. Dollbear; "Lucretius and his Views of Science," Prof. Helen L. Webster, Wellesley College; "Electrical Terms and Units of Measurement," Prof. Wm. A. Anthony.

The Quincy and Boston Electric Street Railway Company has just paid a dividend of five per cent.

A short time ago the New York *World* told an agonizing story of death and destruction in the streets of Boston through the use of the "deadly trolley wire." A few days ago the same journal asserted that within sixty-five days twenty-nine persons had been run over and killed or seriously injured by the street cars in New York. As it happens, New York street cars are not propelled by electricity, yet they appear to be far more successful juggernauts than those we have here in Boston.

There are reported to be 165 stockholders of the Thomson Electric Welding Co. and their average holdings are about 58 shares each. The gross business of the company from Jan. 1, is estimated at over $180,000, and $80,000 from July 1, showing a constant increase. Its patents and applications for patents in this country number 131, against 10 at the organization, and there are foreign patents as well.

The insulated joint illustrated and described in ELECTRICITY a few weeks ago, the invention of Mr. Matthew Prior, of Watertown, Mass., is coming into general use rapidly, and heavy shipments are being made every week. Besides this specialty, Mr. Prior is now making a new type of carbon brush holder, fuse boxes, a turning device for turning up commutators on dynamos without removing the armature, and a unique belt deflector whereby belts can be run unusually loose without the loss of any power whatever. In consequence of the rapid growth of his business Mr. Prior is incorporating as a company and will move his entire plant into a large factory as soon as it is finished.

The Gethins Electric Co., of Boston, has opened up a large and profitable market in India for its standard battery. Recently it has shipped some heavy consignments of batteries, motors and fans to that distant country, where these devices are becoming very popular. W. S. K.

THE PULLMAN CENTRE VESTIBULE TOP-SEAT STREET CAR IN BOSTON.

A trial trip with the new Pullman street car* was made on the tracks of the West End Street Railway Company in Boston, last week. The party on the car was made up of about twenty gentlemen interested in electric railway work, while the crowds in the streets gazed with astonishment and admiration at the handsome and imposing vehicle. The trial was perfectly satisfactory as far as it went, but owing to some small troubles that occurred, it was not carried out as exhaustively as was intended. Another trip will be made very shortly, and all interested in the success of the car are confident that good results will be achieved.

*See ELECTRICITY for October 14th.

A TEST OF THE LEONARD MOTOR-REGULATION SYSTEM.

A very interesting test was made last week by Wm. Sellers & Co., of Philadelphia, on a motor operated under the new principle invented by Mr. H. Ward Leonard. A 10 h. p. standard shunt-wound Sprague motor was used. The normal speed was 1500 revolutions a minute. The motor was belted to a countershaft, upon which was placed a brake and a large fly-wheel such as is used on punching machines, the purpose of the fly-wheel being to duplicate the inertia and momentum met with in practice in a great many kinds of work.

The motor was made to operate in either direction at any rate of speed desired, and it was found possible to run the motor perfectly and regularly under the full brake load at 15 revolutions per minute; that is, 1 per cent. of its full speed. While operating at full speed in one direction the motor could be instantly reversed, the reversal being perfectly gradual and unaccompanied by sparking or trouble of any kind. In order to get the most marked effect in overcoming the momentum of the fly-wheel, the brake was taken off, and when the fly-wheel was running at its full speed of 300 revolutions a minute, the motor was suddenly reversed. In thirteen seconds the motor had brought the fly-wheel to rest, and in thirteen seconds more had it running at full speed in the opposite direction, the entire operation being effected with the greatest smoothness and without any sparking whatever. The performance of the motor was extremely satisfactory to all concerned, and demonstrated the ease with which this system of regulation may be adapted to any class of work to be met with in practice.

WHITMORE AND ROBINSON.

Messrs. Whitmore & Robinson, consulting electrical engineers, 133 Essex street, Boston, have just published a neat little prospectus of their business in the form of a handbook, in which they tersely indicate the lines of business they undertake. Under the titles of "electric lighting, transmission of power, wiring of buildings, estimates, plans and superintendence, testing, purchasing, prices and what we guarantee," many valuable suggestions are made which all users or prospective owners of electric light or power stations, plants and appliances will do well to consider. The authors have had wide and varied practical experience, both in this country and in Europe, and are in every way well equipped for rendering most valuable aid to those who may employ them. At the present time they are doing much important work for some of the leading electric manufacturing companies as well as for individuals. Having a finely equipped laboratory they are prepared to undertake all kinds of high grade work, such as testing, calibrating, etc.

PERSONAL NOTES.

Mrs. M. I. Clark, of Mason City, Iowa, was in town last week looking after supplies for her rapidly growing electric light plant.

G. B. Smeallie, manager of the Electric Lighting Company, of Independence, Iowa, made a short visit to Chicago this week.

Mr. Geo. H. Meeker, western manager for the New York Insulated Wire Company, is now on a trip through the South, looking after the interests of the Chicago branch of this enterprising firm of insulated wire manufacturers.

Mr. S. E. Barton, the universally known president of the Electric Mutual Fire Insurance Company, of Boston, has just returned from a four months' vacation in the West, where he found things moving in a manner that surprised him. Though undertaken entirely for rest and change, the trip was profitable in other respects, inasmuch as Mr. Barton was enabled to make a fairly close study of business methods and prospects.

Mr. George E. Eels has been appointed travelling representative for the Redding Electric Co., and is rapidly building up a lucrative business in every kind of electrical specialties; he has already secured several good contracts.

His many friends will regret to hear that Mr Henry A. Clark, the genial general manager of the prosperous Eastern Electric Cable Co., of Boston, has been laid up, owing to a severe attack of rheumatism in his right arm. For the first time in nearly 40 years Mr. Clark was compelled to absent himself from business.

Mr. C. L. Edgar, general manager of the Edison Illuminating Co., Boston, is home again from his western trip, in the course of which he made a close examination and study of many of the principal electric stations. He is now busy with the building details of the new station to be erected on the old Liverpool wharf, which is to have an ultimate capacity of 10,000 h. p. Arrangements are being made for the installation of 2,000 h. p. in the first instance.

Mr. C. W. Adams, a very talented expert electrician in the Thomson-Houston Electric Works, at Lynn, while riding his bicycle in Everett, a week ago, was run against by a vehicle coming in an opposite direction. He was so seriously injured that he died a few days afterwards, lamented by all his friends and acquaintances.

Mr. Chas. G. Armstrong, who is well known for his expert work in connection with some of Chicago's new sky-scrapers, has just returned from a two weeks trip to Washington and New York in the interest of some of his inventions.

COMMERCIAL PARAGRAPHS.

The Manhattan Electrical Supply Co., of 36 Cortlandt Street, New York, have just issued a new catalogue of 147 pages. It is handsomely made up, profusely and well illustrated and is very comprehensive in its scope. The prices of all articles listed are given and a well arranged index enables one to turn at once to any article wanted. This catalogue will prove of value to intending purchasers of electrical supplies.

The Electric Appliance Company have just closed negotiations for the general western agency for Paranite wires and cables. The Paranite is a rubber covered wire, claimed to have peculiar merits and advantages not found in other high grade wires heretofore on the market. The insulation is made up of an inner layer of pure Para which adheres

firmly to the wire. This is covered by a second layer of Para, which is compounded sufficiently to allow vulcanization, producing a coating of the greatest possible tenacity and high insulating qualities. The whole is then covered with either a tape or braid, making a perfect insulation in every respect. It is at the same time so tough that it can be removed only with a sharp knife, and will allow any amount of kinking, twisting and bending without in any manner affecting its insulating qualities.

The Electric Merchandise Co. received last week a telegram from the Ottumwa Electric Railway Co., of Ottumwa, Iowa, saying "Heaters working satisfactorily. Hurry the others along as soon as possible." "The others" are four additional sets recently ordered by mail.

We are glad to hear that Mr. H. M. Stanley has re-established his electrical house furnishing and general supply business at his old headquarters, 32 and 34 Frankfort street, New York. Mr. Stanley has been long and favorably known to the electrical trade and his many friends will be glad to hear that he has been able to overcome his recent difficulties. He is now associated with another energetic electrical business man, and the new firm will be known as Stanley and Patterson.

The Brigger Belt is a new candidate for favor in the market. This belt is made by weaving leather strips into a mat the width of the belt required and facing this with a suitable thickness of ordinary belt leather,—the two being fastened together by means of a special elastic cement. When the strips are put into the machine for weaving, they are stretched to their full capacity, so that should there be any defect in the strips used they will become apparent at once. The mat, which is on the outside of the belt, is to a certain extent elastic, thus permitting of its adaptation to the curve of longer radius which the outside portion of the belt has to describe in running over the pulley. It is claimed for this belt that it is stronger and more elastic than a solid leather belt, thus permitting it to hug the pulley with a firmer and more even pressure throughout its entire width, and therefore to transmit more power than is possible by the old method.

The Akron Electrical Mfg. Co. are putting on the market a cheap and reliable motor, especially adapted to small manufacturing, such as printing offices, ice cream freezing, sewing machines, etc., for which they report a growing demand. They are also manufacturing the Loomis Street Railway Signal, which enables the superintendent in his office to communicate with all the cars on the line, and permits of inter-communication between cars, thus adapting it especially to single track roads. The same company are exploiting the Loomis Fire Alarm System, which they claim to be the simplest in construction, the most rapid in operation and the least liable to derangement of mechanism, of any on the market.

The Crocker-Wheeler Electric Motor Company, New York City, have just issued a revised and extended catalogue of over fifty pages. To those seeking information regarding the electric motor and its numerous applications, this catalogue will prove of value. The text, which is profusely illustrated, discusses at length the construction of the Crocker-Wheeler motors and their special feateres, and convenient and valuable tables of dimensions, are given. There are also directions for setting up, connecting and running motors. A chapter on "Windings," and a table of sizes and types of motor manufactured for constant potential circuits are useful features. The fire-proof starting, regulating and reversing boxes made by the Crocker-Wheeler Company for their small motors and "Arc" or constant-current motors, for electric fans, electric pumps, etc., are well described. The pamphlet further contains "A Visit to the Crocker-Wheeler Factory," reprinted from the *Electrical Engineer*, New York, and a paper on "Cost of Electric Power—Comparative efficiencies of Large and Small Motors," by Dr. S. S. Wheeler.

The Consolidated Electric Mfg. Co., of Boston, recently opened an up-town office at 152 Franklin St., where it carried a limited supply of its well known specialties. The business increased so rapidly that the accommodation proved altogether inadequate, and Mr. C. E. Bibber, the enterprising general manager, at once determined to lease nearly the entire ground floor of the Shawmut Building, having handsome show windows on Franklin and Congress streets. The intention is to stock the store with a full line of combination fixtures, including electroliers, standards, brackets, and every conceivable style of glass shades and other decorations, all of the most artistic character, the company's own line of manufactured goods and a full line of general electric supplies.

A. J. Wilkinson & Co., 180 to 188 Washington street, Boston, have just issued an elaborately illustrated catalogue of electrical goods and bell hangers' supplies. This firm carries a complete line of electrical supplies and is shipping them everywhere. For those who are requiring goods of this character, or even wanting to study up electrical matters, the catalogue will be found particularly handy. It is to be had on application and is being mailed to all parts of the country.

Bradford, Kyle & Co., Plymouth, Mass., manufacturers of insulated wires, have executed an order for the German Government for silk covered copper wire, No. 47, B. W. G., 20 miles of which weigh one pound, the resistance being 2.5 ohms per foot. It had previously been asserted that such a fine wire could not be so covered, but a special machine was designed and built for the purpose and the output was in the highest degree satisfactory. Users of wire well know that bare wire of this gauge is but little thicker than a single strand of silk.

Locke Brothers, of Salem, Mass., manufacturers of steam appliances, whose specialty is the Steam Damper Regulator in use to-day in nearly 2,000 factories in this and other countries, have issued a very attractive illustrated catalogue which will be of great value and assistance to steam users everywhere. It is illustrated with cuts of regulators, valves, steam traps, governors, etc., and contains much useful information; also a partial list of users of Locke devices and numerous testimonials. It can be had on application to Locke Brothers.

The street car department of the Pullman Palace Car Company report business as being very good. They are equipping a number of electric car trucks with Pullman car bodies. They are also experimenting with a number of new style electric motors.

The Electrical Construction Co., of Chicago, have nearly completed the wiring of the new Leiter building, corner of State and VanBuren streets. This is one of the largest contracts for arc and incandescent wiring that has been closed in Chicago this year.

The attention of passengers in the streets of Chicago is now frequently drawn to the activity in the electrical business, by the appearance of the smart-looking turnout of the New York Insulated Wire Company, bearing the well-known sign of Grimshaw white core wire, and loaded with wire and "Vulca" ducts.

INCORPORATIONS.

The Queens County Light and Power Company, Oyster Bay, N. Y.; capital stock, \$50,000; producing electricity for light, heat and power; promoters, Wm. A. Vail, 163 Joralemon St.; Horace Ironmonger, 195 Hancock St.; Zachariah Latshaw, Alhambra Apartments, all of Brooklyn, N. Y.

The Early Electric Light Company, Richmond, Wayne Co., Indiana; capital stock, \$25,000; is to operate an electric light plant, manufacture and sell electric light in the city of Richmond, and to transact all other business incident thereto; promoters, Chas. Morris, W. N. Gray, Geo. P. Early.

The National Electric Brush Co., Portland, Me.; capital stock, \$500,000; manufacture and sale of brushes and particularly electric hair brushes; promoters, Elmer F. Robinson, Rupert J. Chase and Alex. Stanton, all of Lynn, Mass.

The International Electric Railway Company, Chicago, Ill.; capital stock, \$2,500,000; to construct, build and operate electric railways and manufacture electrical appliances, and furnish electric light, fuel and power; promoters, J. T. Hanna, M. M. Wood, Demas L. Coe.

The Connecticut Smokeless Fuel Gas Company, Chicago, Ill.; capital stock, \$1,500,000; manufacture, supply, sale or distribution of gas, electricity or other product for the furnishing of light, heat, fuel and power; promoters, Thurston G. Hall, Luke T. Drury, Calvin C. March.

The United States Rapid Transit Company, of Chicago, Illinois, Chicago, Ill.; capital stock, \$5,000,000; to build, equip, operate, buy, use and sell mechanical and electrical constructions and devices for the rapid transit of the U. S. Mail, passengers and merchandise; promoters, John Irvine, Isaac T. Dyer, Frank O. Anderson.

Edison Electric Light & Power Co., of Newark, N. J., Newark, N. J.; capital stock, \$1,000,000; promoters, Thos. A. Edison, Orange, N. J.; Moses Biglow, Leslie D. Ward, Elias S. Ward and Henry Young, all of Newark, N. J.; Burd Grubb, Edgewater Park, N. J.

Gardner Electric Light Company, Gardner, Mass.; capital stock, \$30,000; promoters, Roderic L. Bent, F. S. Whittemore, Henry Heywood, Geo. Heywood, H. F. Richardson, Chas. O. Bent and R. L. Bent.

The Latrobe & Derry Electric Street Railway Company, Latrobe, Pa.; capital stock, \$40,000; operating a street railway by electrical or mechanical power in Latrobe, Pa.; promoters, John W. Hughes, Jno. B. Miller, Clate O. Slater, David J. Bush and Jas. E. Heck, all of Latrobe, Pa.

Lancaster & Strasburg Railway Co., Lancaster, Pa.; capital stock, \$125,000; operating a street railway by electric or other than locomotive power; promoters, Jacob B. Long, J. W. B. Bausman and Walter M. Franklin, all of Lancaster, Pa.

Montrose Electric Light & Power Co., Montrose, Pa.; capital stock, \$12,000; promoters, Jas. N. Taylor, O. A. Gilbert and J. D. Jenkins, all of Montrose, Pa.

Tamaqua and Lansford Street Railway, Tamaqua, Pa.; capital stock, \$50,000; operating a street railway by electric power in Schuylkill Co., Pa.; promoters, D. D. Philips, Gordon, Pa.; Robt. Harris, Tamaqua, Pa.; C. R. Eberle, Philadelphia, Pa.

The Bellefonte Street Electric Railway, Bellefonte, Pa.; capital stock, \$18,000; promoters, L. A. Schaefer, W. F. Reeder and Jas. H. Potter, all of Bellefonte, Pa.

The Electric Appliance Company, Chicago, Ill.; capital stock, \$30,000; manufacturing, buying and selling goods and merchandise and electrical appliances, supplies and apparatus; promoters, Charles S. Grover, Benj. F. March and Wm. H. Joplin.

Fairmont Investment & Construction Company, Fairmont, W. Va.; capital stock, \$250,000; acquiring real estate and erecting buildings thereon, erecting and operating electric lights, planing mills, etc.; promoters, O. J. Sands, Thos. F. Hall and W. A. Clayton, all of Fairmont, W. Va.

Clay and Forest Park Railway Company, St. Louis, Mo.; capital stock, \$50,300; build and operate by electricity or cable a passenger railway for public use; promoters, T. K. Skinker, J. L. Boland, B. F. Thomas, V. B. S. Buchanan, R. E. Carr, all of St. Louis, Mo.

ELECTRICAL PATENT RECORD.

Letters Patent Issued Nov. 10, 1891.

DYNAMOS AND MOTORS.

462,890. Commutator. Sidney H. Short, Cleveland, Ohio. Application filed May 26, 1891.

462,891. Armature for Dynamo Electric Generator. Sidney H. Short, Cleveland, Ohio. Application filed June 12, 1891.

462,892. Armature for Dynamo Electric Machine. Sidney H. Short, Cleveland, Ohio. Application filed June 19, 1891.

462,883. Brush Holder for Dynamo Electric Machine. Sidney H. Short, Cleveland, Ohio. Application filed July 6, 1891.

462,973. Brush Holder for Dynamo Electric Machine. Elihu Thomson and William O. Wakefield, Lynn, Mass. Application filed Feb. 20, 1891.

463,121. Steam Dynamo and Electric Machine. Frank M. Garland, New Haven, Conn. Application filed Feb. 4, 1891.

ELECTRIC RAILWAYS.

462,688. Electric Railway System. Henry C. Camp, St. Paul, Minn. Application filed June 30, 1890.

462,707. Device for Removing Ice from Overhead Wires. Geo. H. Hipwood, Boston, Mass., assignor of two-thirds to Horatio C. Barrett. Application filed Aug. 24, 1891.

462,751. Electric Railway Motor. Chas. J. Van Depoele, Lynn, Mass. Application filed Dec. 20, 1890.

462,793. Electric Car Brake. James D. Collier and James K. Miller, Woodville, Texas, assignors of one-third to John H. Kirby. Application filed Feb. 4, 1891.

462,794. Electrical Connection for Railway Cars. James D. Collier and James K. Miller, Woodville, Texas, assignors of one-third to John H. Kirby. Application filed March 25, 1891.

462,807. Electric Car Coupling. James D. Collier and James K. Miller, Woodville, Texas, assignors of two thirds to John H. Kerby. Application filed Feb. 18, 1891

462,814. Life Guard for Railway Motors. Henry A. Harris, Rochester, N. Y. Application filed June 27, 1891.

462,850. Electric Circuit-Closing and Breaking Device for Railway Tracks. Thomas H. Palmall, Rahway, N. J. Application filed Feb. 20, 1891.

462,926. Heating and Lighting System. Rudolph M. Hunter, Philadelphia, assignor to the Electric Car Company of America. Application filed Jan. 12, 1887, and Sept. 27, 1887.

463,070. Electric Railway System. Granville T. Woods, New York, assignor to the American Engineering Company. Application filed Aug. 31, 1891.

463,024. Reversible Electric Trolley. Joseph W. Bates and Carlostine E. Blake. Application filed Dec. 22, 1890.

LAMPS AND ACCESSORIES.

462,750. Electric Arc Lamp. John E. Giles, Hazelton, Pa. Application filed Jan. 29, 1891.

462,756. Carbon Holder for Arc Lamps. James J. Wood, Brooklyn, N. Y., assignor to Fort Wayne Electric Company. Application filed Dec. 10, 1890.

462,936. Mechanical Cut-Out. Harry W. Burnet, East Orange, N. J. Application filed April 7, 1891.

463,035. Electric Arc Lamp. James E. Gaston, Sparta, Ill. Application filed Jan. 15, 1891.

CONDUCTORS, CONDUITS AND INSULATORS.

462,681. Electric Conductor. John A. Barrett, Brooklyn, N. Y., assignor to Standard Underground Cable Company. Application filed Jan. 8, 1891.

463,079. Electric Conductor. Chas. P. Snedekor, New York. Application filed May 8, 1891.

463,107. Electric Conductor. Fred Degenhardt, Chicago, Ill., assignor to the Standard Underground Cable Company. Application filed Sept. 1, 1890.

TELEGRAPH, TELEPHONES AND SIGNALS.

462,720. Telegraph Table, Katie V. Miller, Lewisburg, Alabama. Application filed Sept. 23, 1890.

462,741. Police Signal Telegraph System. Chas. A. Rolfe, Chicago, Ill. Application filed March 9, 1891.

462,786. Fire Alarm Box. Edmund R. Wilder, Kansas City, Mo., assignor to the Wilder Duplex Burglar Alarm and Messenger Co. of West Virginia. Application filed Jan. 2, 1891.

462,808. Police Signal System. Nathaniel B. Cregier, Chicago, Ill., assignor of one-half to Dewitt C. Cregier. Application filed Nov. 26, 1889.

462,813. Signal Device for Telephone Pay Stations. William Gray, Hartford, Conn. Application filed Dec. 15, 1890.

462,934. Signaling Device for Elevators. Chas. G. Armstrong, Chicago, Ill., assignor of one-half to Dankmar Adler. Application filed Jan. 17, 1891.

462,835. Electrical Indicator for Elevators. Chas. G. Armstrong, Chicago, Ill., assignor of one-half to Dankmar Adler. Application filed March 10, 1891.

462,901. Duplex and Quadruplex Telegraphy. Francis W. Jones, New York. Application filed Nov. 11, 1891.

463,001. Electrical Annunciator. Joseph B. Smith, Manchester, N. H., assignor to Electric Gas Lighting Company, of Maine. Application filed 1889.

BATTERIES.

462,693. Secondary Battery. Nathan H. Edgerton, Philadelphia, Pa. Application filed Jan. 14, 1891.

MISCELLANEOUS.

462,732. Electric Belt. P. E. Petterson, Minneapolis, Minn. Application filed March 11, 1891.

463,086. Electric Safety Cut-Out Device. Addison G. Waterhouse, Hartford, Conn. Application filed June 24, 1891.

ELECTRICITY.

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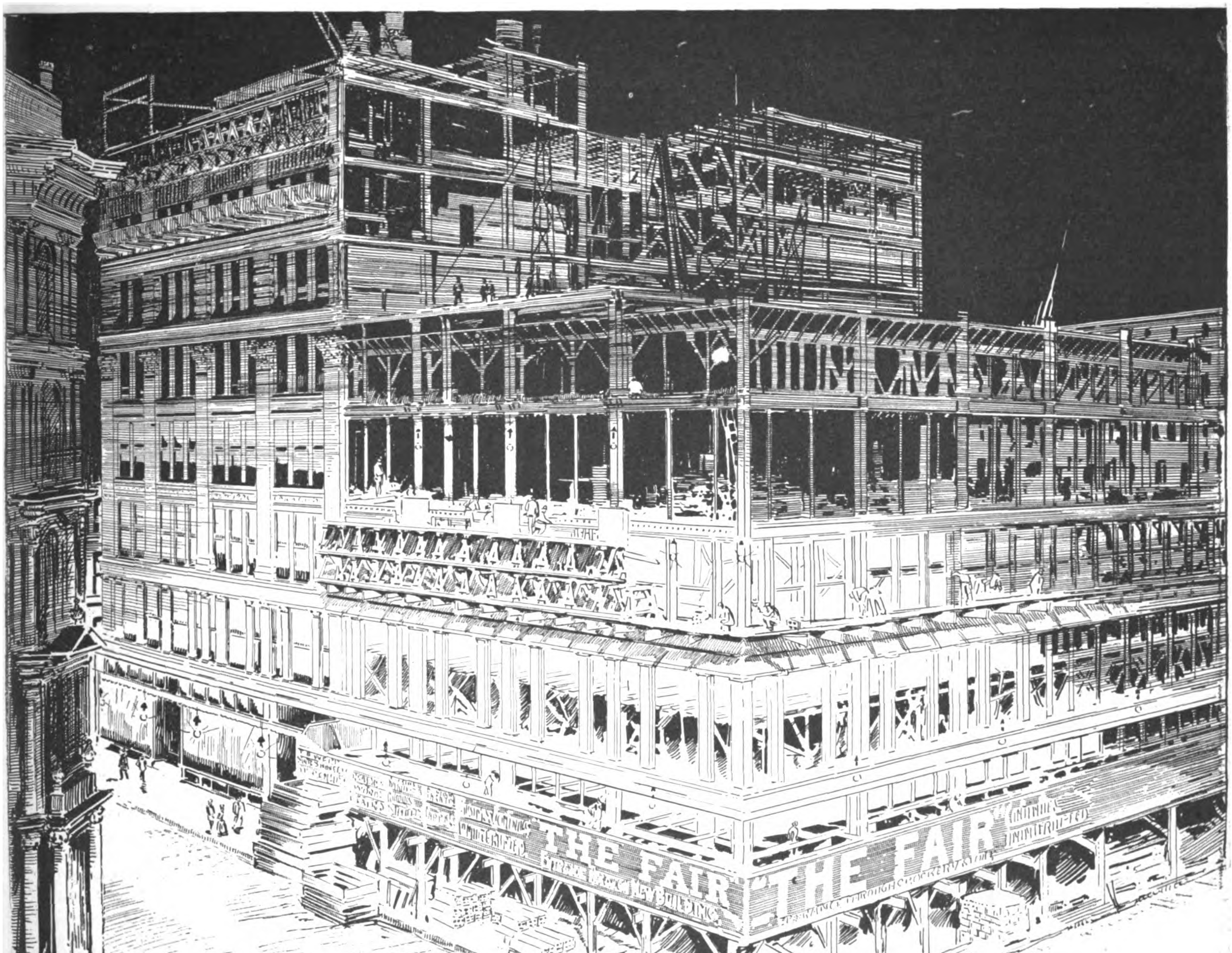
ELECTRICITY.

Vol. I. | Chicago. | NOVEMBER 25, 1891. | New York. | No. 19



A CHICAGO BUILDING—NIGHT CONSTRUCTION WORK.

(See page 240.)

THE "CHICAGO" STYLE OF BUILDING.

The subject of our frontispiece this week is the magnificent and imposing building now in course of construction in Chicago, known as "The Fair." This building is especially interesting on account of the methods employed in its construction, and the important part played by electricity in the advancement of the work. The old building now being replaced by the new had a frontage of 190 feet on Dearborn street, 351 feet on Adams and 190 feet on State street. The new building is of what has become known as the "Chicago" style of architecture, and is being constructed so as not to interfere at all with the business of the Fair Company.

In order to accomplish this, but one quarter of the original structure was torn down at first. Work was begun on this first quarter in January last. Four stories were erected and a temporary roof thrown over at the fifth story, and on July 4th, this part of the store was opened for business. The second quarter of the old building was then demolished and excavations for footings were begun on July 25th. In the meantime construction proceeded on the upper floors of the first quarter, and at the present writing it has reached the ninth floor and a second temporary roof has been built. The first four stories of the second quarter, for which as before stated, ground was broken on July 25th, were completed and occupied for business on Nov. 14th. In this, as in the first quarter, a temporary roof was erected on the fifth floor, and another one will be placed on the ninth floor.

Our illustration represents the second quarter with the first temporary roof. When it is considered that each of these quarters occupies a ground space of 95x166 feet, and that since Jan. 1st 1891, a structure 190 feet by 166 feet, and four stories high has been erected and opened for business, and construction is still proceeding without interruption to or interference with that business, the magnitude of the task will be appreciated.

But all this could not have been accomplished without the aid of electricity. When the basement of the first quarter was begun, six arc lights were installed and connected to the Chicago Arc Light and Power Co's circuits, and as the structure rose higher, more lamps were added, thus enabling the work to proceed throughout the night. When the first four stories were completed, the Fair Company installed an electric plant of their own, and this has furnished light for night work on the second quarter. The plant consists of three 175 h. p. high speed engines, made by the Phoenix Iron Co., of Meadville, Pa., which drive Sperry dynamos capable of supplying current to 580 1,200 c. p. arc lights, and 700 incandescent lights. This plant will supply the first eight stories, at which height the building will remain for the present, but there is ample room for an extension of the plant to supply the whole building, which, when completed, will be 241 feet high divided into 17 stories, and will require 1,250 arc and 7,500 incandescent lamps. The total floor space of this immense structure will measure 980,000 square feet.

Inquiries from the architects, Messrs W. L. B. Jenney and W. B. Mundie, and the contractors, Messrs Geo. A. Fuller, & Co., elicit the fact that by the aid of the arc light, construction may be pushed as rapidly at night as in the day time, thus more than doubling, in winter, the available hours for building purposes. The feat already accomplished in the construction of this building is probably the most remarkable of its kind in this remarkable age of rapid work in all directions, and reflects great credit upon all who have been connected with it; and it is highly probably that the success attending the use of the arc light in this instance will lead to its general adoption in like undertakings elsewhere.

EXPERIMENTS WITH HIGH TENSION CURRENTS.

We have already referred in these columns to the experiments with exceedingly high tension currents that have been conducted by Siemens & Halske at Frankfort. The following description of some of the phenomena attending these experiments, which appeared in *Engineering*, Oct. 30, cannot fail to be of interest:

It is almost impossible to convey by words any idea of the visible phenomena accompanying the efforts of a 40,000 volt current to bridge an open space, but we will attempt a description of what we saw one evening last week. Upon a table there was fixed an electrode, some 3 in. in diameter, connected to one terminal of a transformer. Over it there was mounted a large sheet of glass 3 millimetres thick, and above the glass there was a second electrode terminating in a sharp point, the distance between the electrodes being 3 centimetres. When the current was turned on to the primary coil of the transformer there first appeared a purple haze at the upper electrode, streaming towards the glass; as the current increased this haze grew in fulness and definition, and began to throw out feelers which darted outwards, and as quickly withdrew. As the electromotive force augmented still further these feelers gathered power until they beat themselves violently on the glass, as if they would force themselves through it in their mad desire to reach the other electrode, The whole space below the pointed conductor became alive with them, and exhibited a mass of leaping, crackling threads of purple fire, which writhed and twisted in impotent attempts to burst through the barrier, and failing that, spread themselves along its surface endeavoring to rush over its edges, and so reach their goal by a circuitous route. But this was beyond their strength until the electromotive force approached 45,000 volts, when suddenly the entire appearance was changed. The current overleapt the edges of the plate and flowed completely round it in all directions. At that moment the intense purple color of the spark disappeared, and was replaced by white light of the greatest brilliancy, which surged and scintillated in a way that produced acute fatigue of the eyes in an extraordinarily short time. Although steadier than before, the discharge still kept up its spark-like character, enfolding the glass plate in gleaming coruscations, which glistened and flashed until the spectators were fain to turn away their bedazzled gaze.

A change in the arrangement was then made. The upper pointed electrode was replaced by a brass disc 3 in. in diameter. This was laid over the surface of the glass plate with three very thin washers of vulcanite intervening between the two. The current was then turned on, in the same gradual manner as before. The space between the two discs immediately filled with purple light, which had sufficient motion in it to recall the flame of a Bunsen burner, spread out under the bottom of a beaker. Sparks then began to appear at the edges, and, as they gathered strength, to radiate a little beyond them. Gradually they became streamers stretching out along the surface of the plate, in curved fanciful forms which twined and twisted and weaved themselves into a glistening filagree, compared by an imaginative spectator to an agonized Japanese chrysanthemum. This experiment had not the brilliant refulgence of the one that preceded it, but was characterized by a quivering irradiation which writhed and tossed like a bird beating itself at the bars of its cage. In spite of its less formidable appearance, however, it proved destructive to the glass, which presently flew in pieces with a crash. Several sheets were tried in succession, but each was pierced and broken, and allowed the current to attain its object of flowing directly from one electrode to the other.

The last demonstration showed an arc under a pressure of 44,000 volts. When the electrodes approached to within five inches the arc established itself, but instead of the flames bridging the space they streamed out into two thin tongues at right angles to the electrodes, and parallel to each other. If the electrodes were pushed nearer together the flames deserted their extremities and wandered back along their stems, evidently repelling each other. The light produced was, of course, very small indeed.

In conclusion, we may add that the voltage was reached by two transformations. An eighty volt current was first raised to 2,000 volts by one of Siemens' cable transformers, consisting of a long core of wire rope, composed of soft iron wires covered with a layer of specially prepared insulating material, around which are wound two insulated conductors, forming one the primary and the other the secondary circuit of the transformer. The secondary current was then raised to 45,000 volts by a transformer of the usual type.

LIEUT JARVIS PATTEN'S IMPROVED ALTERNATING MOTOR.

A description of Lieut. Patten's recent alternating motor will be interesting to many readers. The system he applies is based upon the principle of subdividing the alternating current and delivering to separate circuits the positive and negative impulses that come from the converter. This method requires a perfectly synchronous machine, or one the moving part of which makes uniformly a definite and corresponding movement in space for each successive impulse of current delivered by the generating plant. This result has been thoroughly accomplished in recent machines, and it is understood that Mr. Mordey (in England) has also succeeded in charging storage batteries with the alternating current on the same plan used by Lieut. Patten in his latest machines. The impulses of opposite direction are sent through the opposite halves of a divided battery as an intermittent direct current for each half in turn. The machine and the manner of operation will be readily understood from the accompanying diagram of the working circuits.

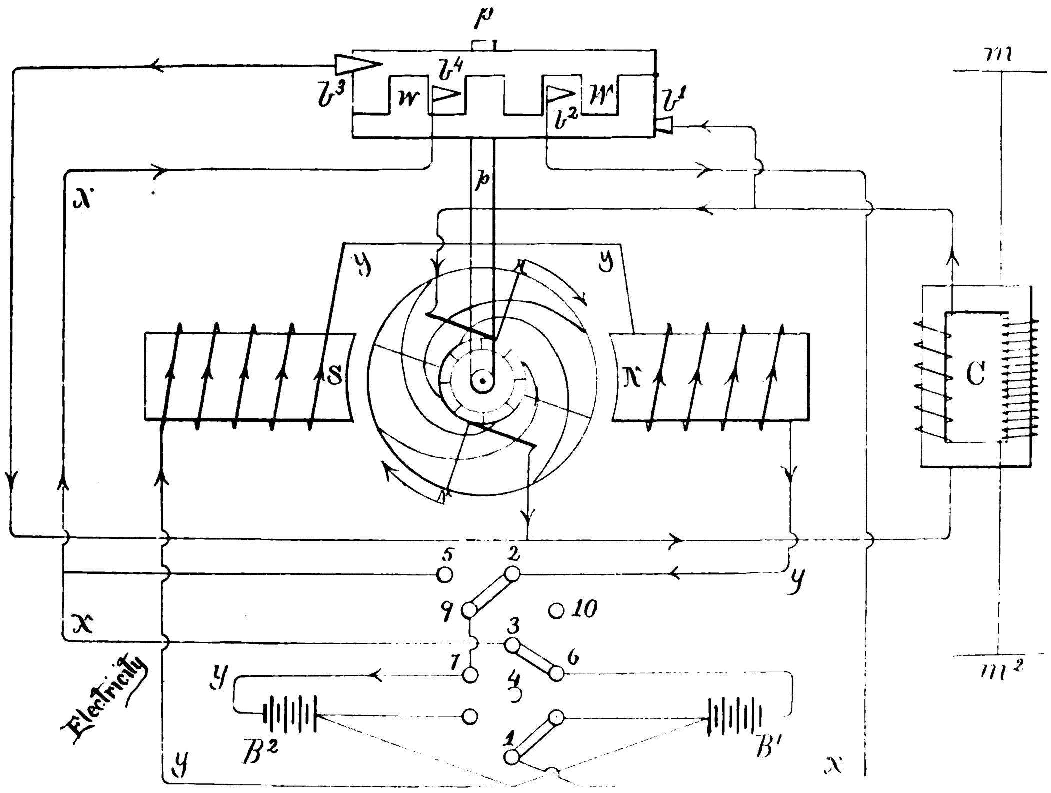
The rectified alternating current has been applied by many inventors to the driving of motors and the various methods used are similar in most respects; they all suffer, however, from the disadvantage that while the rectified alternating current produces an apparently constant magnetization of the field or armature, this excitation is really not constant but is variable and pulsating in character, and, in the event of imperfect commutation of the current, it becomes intermittent and has actual zero periods of appreciable duration. These conditions, which are scarcely avoidable with a commutated alternating current, necessarily place such machines at some disadvantage when compared with those having an ordinary direct current supply. The same principle has received ample and beautiful illustration in the recent German multiphase machines, in which the disadvantages introduced by the pulsating magnetism produced by using two currents having a quarter phase difference, is almost entirely overcome by using three or more currents that follow each other at a corresponding interval.

In his latest machine Lieut. Patten obtains an even and constant magnetization of the field by causing the rectified alternating current to charge a storage battery, which in turn is used as an independent and separate exciter for the field.

A Gramme armature is connected to its collector segments on the plan (shown in the diagram) invented by Lieut. Patten some years ago, in which each successive commutator bar is connected reversedly, that is, one to the point of the ring winding adjacent to it and the next to a point diametrically opposite to the segment. Under

these conditions, if the armature turns through the arc covered by one collector segment for each pulsation of current, the polarity of the ring will remain unchanged, as can be seen in the diagram by tracing the circuits for two consecutive positions. If supplied with a direct current this armature would vibrate back and forth.

This arrangement of the circuits of the armature also prevents any possibility of the machine starting backwards. Besides this it has other remarkable qualities; while it insures perfect synchronism, this does not mean that the machine must run at the same speed as the generator, but only that its speed must be such that one collector segment shall pass the brush for each pulsation of current, so that synchronism, far from being in any way a disadvantage by fixing the speed, simply means perfect regulation and a constant speed under all loads. To the spindle of the armature is secured a rectifying commutator W,



Patten's Improved Alternating Motor—Diagram of Circuits.

W, shown in the drawing developed or unrolled. Through the brushes this commutator sends a current of uniform direction along the circuit marked x, x, charging the storage battery B', while the fields of the machine are in the independent circuit y, y, supplied by the battery B^2. Switches are connected, as shown, for placing either battery on the field and the other on the charging circuit and this change may be effected automatically.

The machine is evidently a self starter, as by connecting the field in the circuit x, x, both field and armature would be excited by the alternating current with constantly reversing polarities and the machine would start the same as would an ordinary direct current machine when connected to an alternating circuit. When up to speed the field is switched on to the battery exciter. A machine of this type weighing ninety pounds has developed one and one-half h. p. without heating of any consequence.

TRIALS OF AN INVESTIGATING COMMITTEE.

A somewhat acrimonious discussion on the electric lighting system of Chicago was recently provoked by the City Council of Milwaukee. A delegation from Milwaukee, composed of members of the council, visited Chicago as an investigating committee to inquire into the question of electric lighting, which is just now interesting their city. On their return to Milwaukee they claimed that certain city officials and representatives of an electrical company had misinformed them by presenting figures showing that $190 per lamp per year was the price that Chicago paid for electric lighting. It was claimed that misrepresentations has been made to the committee in order that a local electric light company of Milwaukee might receive the contract for lighting certain parts of the city. After a general explanation from both sides it appears that the committee misunderstood the figures placed before them and that no misrepresentations were made.

A NEW USE FOR THE TROLLEY WIRE.

During a recent celebration of Maj. McKinley's victory at Canton, Ohio, the Morgan Engineering Club, 100 strong, produced a decided sensation by carrying incandescent lamps fed with current from an overhead trolley wire along the route of which the procession moved. The effect is said to have been decidedly novel and is certainly putting the trolley wire to a new use. Deponent saith not how the ground connection was made, but we trust it was not through the bodies of the lamp bearers.

At the last meeting of the Chicago Society of Operative Electricians, Mr. J. K. Pumpelly read a very instructive paper on the subject of the storage battery, its success and some of the causes of its failure. The paper was prepared and intended, as the writer said, for a class of young men not thoroughly versed in the technical terms commonly used in papers on electrical subjects. The subject was treated in a very instructive manner. Before adjournment the society extended a vote of thanks to Mr. Pumpelly and his name was submitted as an honorary member of the society.

Our contemporary *Electricity* (London) says:

The longest electric railway is, it appears, to be constructed in Russia. A project is at present being considered in that country which exceeds in audacity all previous ideas of electric railways. It is proposed to construct a line from St. Petersburg to Archangel, the well-known port on the White Sea, a distance of 800 kilometres, or 500 miles. The electric current will be supplied by a series of generating stations placed at intervals along the route.

The linemen and wiremen of America are now in session at St. Louis, discussing the formation of a linemen's union. Presently we shall have walking delegates going round after a storm ordering linemen to stop work on non-union wires.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The action of the British Royal Commissioners to the Columbian Exposition, charging exhibitors for space, has caused considerable comment in electrical circles. The question has been raised whether the action of the commissioners would tend to discourage manufacturers and other intending exhibitors from taking part in the exhibition and whether the precedent would be followed by similar action on the part of the commissioners from other countries. Chief Fearn, of the Foreign Department (who is well qualified to speak on this question, as he has resided in England for a number of years), in expressing his opinion to a representative of Electricity, said, "I do not think that the action of the Royal Commission will unfavorably affect the exhibit from Great Britain in the least degree. In fact, I believe it will help to bring out a better class of exhibits and tend to discourage a certain class of exhibitors that have been a drawback to the success of previous expositions. My experience in England has taught me that Englishmen, as a class, are perfectly willing to pay for what they get as long as there are no impositions thrust upon them. In regard to the setting of a precedent for other countries I believe that each country intending to make an exhibit will establish its own rules and regulations without regard to anything that may have been done by any other country."

The grounds and buildings committee have decided that no separate building shall be allowed on the Exposition grounds for special exhibits from foreign countries. This decision was made after a number of German electricians had applied for separate buildings. The committee gave two reasons for declining the application, first, that to grant it would establish an embarrassing precedent, and second, that the electricity building was large enough for all the displays that will be offered in that line.

The German electricians, in their letter, also asked whether the employes who came over with them could find hotel accommodations at the exposition grounds, and Chairman Clowry was instructed to reply that while the exposition company would not conduct boarding houses on the grounds, it would certainly provide proper accommodations for that class of employes.

In regard to an inquiry about the protection of foreign patents, Solicitor General Butterworth said that "the patent laws of this country are more rigid than those of any other country on the globe. Foreign exhibitors will receive all the protection they could ask, and more, in fact, than they are afforded at home. In this country a man can use a new invention two years before having it patented, if he desires, and the same rule would apply to foreign exhibits."

A new foundation for a 250 h. p. Armington and Sims engine is being built in the temporary electric light station. The engine is expected to arrive next week and will be used for driving the generators. Two 20 Kilowatt and one 30 Kilowatt motors have been received at the grounds, and will be immediately installed.

An addition is being built to the south end of the electric light station. It is to be used as a machine and blacksmith shop for repairing all the machinery under the charge of the commissioners during the period of construction and installation.

R. H. Pierce has been appointed assistant to Electrical Engineer Sargent. Mr. Pierce was formerly a member of the Electrical Engineering Company, of Chicago.

The London *Daily Telegraph* says that at the Lord Mayor's show the stage coach was fitted up with electric lights. This was the first time that electricity has played such an intimate part in the induction of the Lord Mayor into office.

HOW THE DYNAMO GENERATES ELECTRICITY.

BY NELSON W. PERRY, E. M.

If one holds a stone out at arm's length and lets go, it will fall to the ground. If the question is asked "why?" the usual answer is that "it is according to the laws of gravity," and this answer is generally considered sufficient. That a stone *will* drop, that it invariably drops downward and that the farther it drops the faster it goes are matters of common observation; so Newton discovered nothing new in this. But in examining into this motion closely he found that the acceleration was as sure to amount to a certain quantity as the stone was to drop, and he found out by experiment what that quanity was. When he had found out this and a few other things and told about them he had announced the law of gravitation.

So we see that when the above answer is given it is equivalent to saying that "the stone drops because it drops with a certain increasing speed," which is indeed a very unsatisfactory answer. Newton did not find out what gravity is, neither has anybody since his time. It is as inexplicable to-day as it was then, but its manifestations are matters of such common observation that they excite in us no surprise.

Faraday observed that when he moved a copper wire across the face of a magnet, an electric current was generated in that wire. He did not know what electricity was, neither does anybody to-day, neither did he know why the electric current was generated by moving the wire in that way, but he found that the current was always generated if he did so. It was also discovered that if a wire were thus moved before the north pole of the magnet the current took a given direction, while if moved in the same way before the south pole of the magnet, it took the opposite direction, and this was invariable. He did not know why, but it became a matter of common observation with him and no longer excited surprise, but he went to work to study the phenomenon in its various aspects and we must do the same. We must not ask why the current is generated, for if we do we will get no more satisfactory answer than we did in regard to the question about the falling stone. We must accept this as a fact, and as a matter of common observation.

Starting from this point, then, let us suppose that an infinite number of parallel wires, say in the same plane, be moved across the face of the north pole of a bar magnet, one after another, in rapid succession. As each of them passes the pole there will be generated in it a momentary current of electricity in a given direction which we will call positive. If, as each wire passed the pole it were caused to make contact at both ends with a certain wire loop, so that at the moment the contact was made that loop became closed, there would be a succession of momentary currents flowing from the positive end of the moving wire around the loop to the negative end of the moving wire, and these electrical impulses would follow each other around the loop as rapidly as the loop was closed by moving wires in front of the magnet. Let us suppose this procession of wires to continue moving and all the other arrangements remaining the same; we then reverse the magnet so that they now are passing before its south pole. We have seen that if a positive current is generated in a wire passing in a given direction before a north pole, it will be generated in a negative direction in passing a south pole. What is true of one wire is true of an infinite number, hence we will now have a series of currents flowing around our loop in the opposite direction to that taken before.

Suppose now we bend our bar magnet into a horseshoe form, so that each wire will pass first the north pole and then the south pole, and arrange our loop so that its ends will be in contact successively with each moving wire until after they have passed both poles. It is evident there will be a current passing around the loop in one direction as the moving wires pass the north pole, and in the opposite direction as they pass the south pole. That is to say, every time a moving wire passes the two poles of the magnet the current will be reversed in the loop. But if we should contrive an arrangement by which the ends of the loop changed their connection to the opposite ends of the moving wire the moment the latter passed the south pole, the current generated in a negative direction in the moving wire would then have the same direction in the loop as it had before, because the latter has been changed end for end. We should now have a series of currents *in the loop* in the same direction instead of in alternating directions. If this change were repeated at sufficiently short intervals we should have a practically continuous current in the loop, although in the moving wires it would alternate in direction as they passed the two poles.

This changing from end to end of the loop is called "commutation," and the device by which the change is effected is called a "commutator." But instead of having an infinite number of wires moving in the same plane, it is evident that the same results would follow, provided only the procession be kept up; and this can evidently be accomplished indefinitely with but comparatively few wires by laying them longitudinally upon a cylinder and causing the latter to revolve. This is what is done in the dynamo, and this revolving cylinder is known as the "armature." The loop we have spoken of is the circuit to which are connected the lights or motors. The ends of this loop terminate in stationary flexible pieces of copper which bear on the moving wires just at the right time to close the loop as the wires pass the poles of the magnet before which they revolve, and so arranged that, by no movement on their part, the ends of the loop are reversed in their connection with each moving wire as it passes opposite poles. These flexible terminals of the loop are technically termed "brushes." In the dynamo the ends of the moving wire are usually each soldered to a bar of copper provided to better resist the wear of the brushes, and these bars of copper are arranged in the form of a small cylinder fixed on the armature shaft and revolving with it. This small cylinder of copper bars, which are nothing more nor less than the ends of the moving wires, constitutes the "commutator."

There is another phenomenon that we have not yet mentioned. It is a matter of common observation among those who experiment in this line that if the cylinder on which the wires are placed be made of iron, the effect of generation of current is enormously increased. If the armature were of wood, for instance, a current would still be generated, but it would be feeble. By making it of iron, many times as much electricity will be generated with the same number of moving wires. But no new principle is involved in this, it is merely an intensification of the effects produced by the principles already described. Since the best results are obtained with iron, that metal is always employed.

The stronger the magnets before which the armature revolves, the stronger the effects, hence the strongest magnets that can be made are used. Since electromagnets are stronger, weight for weight, than any permanent magnet that can be made, we usually find them in electrical machines. But electromagnets require the use of electricity to excite them. Whence is this obtained? It may be obtained either from a battery or from another dynamo, but is most usually obtained from the machine itself. In the latter case, which constitutes the true dynamo-electric machine either a part or the whole of the current generated by it is caused to pass through the magnet coils before passing out to do useful work, or in other words the magnet coils constitute part of the loop.

But the question arises, how are we going to excite our magnets when we start the dynamo from a state of rest and when it is generating no electricity, and when therefore there is none to energize the magnets?

This was one of the most remarkable discoveries in the history of electricity. All iron contains *some* magnetism, however slight, due to the magnetism of the earth. When the armature is started this very slight magnetism generates a feeble current, which, passing around the magnets, increases their magnetism the least bit, this results in more current and that again in more magnetism, and so on until the magnets become as strong as they can be made and the largest current, of which the machine is capable, is generated. There is a kind of building up from almost nothing to a maximum, due to the mutual reaction between magnetism and electricity.

MR. H. WARD LEONARD'S NEW METHOD OF OPERATING MOTORS.

The silence heretofore imposed upon Mr. H. Ward Leonard by the pendency of foreign patents, in regard to the methods employed by which he claims to operate motors automatically at any desired speed or torque, and with maximum efficiency under all condition, is at last broken, and he has communicated to ELECTRICITY the details of his system, the salient features of which are now for the first time given to the public. He says:

"As a result of my investigation I have concluded that the operation of electric motors should conform to what apparently is a new law, and which may be stated as follows:

Vary the voltage as the speed desired.

Vary the amperes as the torque required.

In other words, make the speed dependent upon the voltage only, and independent of the current, and make the torque dependent upon the current only and independent of the voltage. Since the product of the speed and torque represents the work being done, and the product of the volts and amperes represents the power supplied, it is evident that if we can operate in conformity to this law, we shall have a constant efficiency under all conditions, disregarding, of course, the small fixed losses in the field and armature.

One way in which this law can be followed is to supply the field of the motor from one source of electric energy and supply the armature from another source, the E. M. F. of which can be varied. It will be noticed that when the speed is fixed a fixed voltage will be necessary in order to conform to the law, and the shunt motor is found to conform perfectly to the law; but it is the only motor I know of which does conform to the law which seems to be generally applicable.

"In order to conform to the law in a simple way, we will install a generator and motor of the same size and connect their armatures by two conductors. We will supply their fields from a small separate exciter in the shape of a shunt-wound dynamo. In the circuit leading to the field of the generator we will place a rheostat. If now we drive our generator at a constant speed, the E. M. F. it will produce will depend upon its field, which in turn will depent upon the amount of resistance in the rheostat in its field circuits. The strength of the motor field is constant, being supplied by the constant E. M. F. exciter. Now, evidently the speed of the motor will depend solely on the E. M. F. supplied to its brushes, and this can be varied from 0 to the maximum limit by varying the rheostat, which will preferably be placed beside the motor itself. The current will automatically vary in proportion to the torque, the speed will vary directly as the voltage and the efficiency will be constant and independent of the speed or torque.

"If we wish to operate an elevator from central

station conductors of constant E. M. F., we supply a shunt-wound motor mechanically connected directly with a generator, whose armature is connected to the armature of the elevator motor. The field of the generator is supplied from the central station conductors, but a loop goes up the elevator car, where a rheostat and reversing switch is placed, so that the E. M. F. of the generator can be varied and reversed at will. The field of the elevator motor is excited from the line constantly."

It is claimed for this arrangement that "since the maximum weight alone determines the maximum amperes it will be impossible to send more than the normal full load in amperes through the armature, consequently the liability of burning out of armatures is reduced to a minimum" and that "the elevator in coming down generates current to assist the central station."

"Suppose," he says, "we want to operate a swing bridge by an electric motor. We connect as in the arrangement first cited, but instead of a hand field rheostat we use an automatic field rheostat, such as is used by the Edison Company. We place an amperemeter in the armature circuit of our motor, and when the amperemeter needle indicates full load it touches a contact leading to the relay magnets of the automatic rheostat, which causes it to throw in resistance in the field circuit of the generator and reduces its E. M. F. Similarly, just below full load, the amperemeter needle makes contact, closing a circuit in the automatic rheostat so as to throw out resistance and raise the E. M. F. of the generator.

"To start up the bridge we insert all of our resistance in the field of the generator and have, let us say, no volts. Now we close the main-line switch to the motor; we will have no current; hence the amperemeter needle will be on the lower contact, which will gradually throw out resistance and cause the generator to generate an E. M. F. The current will increase and will finally cause the needle to leave the lower contact. The full torque is now being developed, and the bridge, if the motor be of proper size, will start to move. As it does so, the counter E. M. F. of the motor will tend to reduce the current, but this will cause the needle to again make the lower contact and raise the E. M. F. and speed, and hold the current and torque constant.

"Thus, the bridge will start from rest with a minimum of power but full torque, and will gradually accelerate in speed until the full E. M. F. and speed of the motor is reached. To vary the speed by hand we merely move the amperemeter needle to make either contact desired. In case the bridge should meet an obstruction which would slow it down, the amperes would not increase, but would remain constant, as the volts would be immediately and automatically reduced to just that amount necessary to keep the amperes constant. With this arrangement it would be practically impossible to overload the motor armature.

"For operating an electric railway we will place a shunt-wound motor on the car, and directly driven by this motor will be a special generator, which will be connected to the electric motor below the car. It is evident that the generator and working motor armatures may be wound for any voltage desired, say 20 volts, which will make the problem of insulating the street-car motor an extremely simple one. If desirable, we can supply several cars of a common train from one special generator on the forward car. With this outfit we will be able to take any car up any practicable grade or around any curve with no more power than is required to move the car on a level, and always consume the same power, regardless of weights, grades or curves. That is, the automatic increase of current, to take care of any increased torque, will be compensated for by a corresponding decrease in the volts and speed. We may start a car up on any grade or curve with but a small fraction of the power required for normal speed on a level."

Mr. Leonard also claims that since alternating current generators will operate perfectly as motors, provided the speed and torque be kept constant, and that by his system these two conditions can be fulfilled, it will enable alternating currents to be successfully employed in street railway traction.

In conclusion he says:

"For power in which smoothness of motion in starting and stopping is not essential I have devised a new system of distribution as follows: Three dynamos, all having the same current capacity and having voltages of 62½, 125 and 250 respectively, are placed in series and conductors led off in multiple one from each terminal of the machines. These conductors will have potentials which can be represented by 0, 62½, 187½ and 437½. Let us now take a shunt-wound motor, and disconnecting the field from the armature circuit, excite the field from the outside two of the four conductors, that is, by an E. M. F. of 437½ volts. By connecting the armature terminals to the four conductors in various ways we shall be able to operate in either direction at six different automatic speeds represented by the following voltages: 62½, 125, 187½, 250, 275, 437½. By varying the field strength of the motor we can, if required, get any intermediate speed.

"In many cases two dynamos will answer, one of say, 110 volts already in use for incandescent lighting, and a second of, say, 30 volts. With this arrangement we could run in either direction and with automatic speeds represented by 30, 110 and 140.

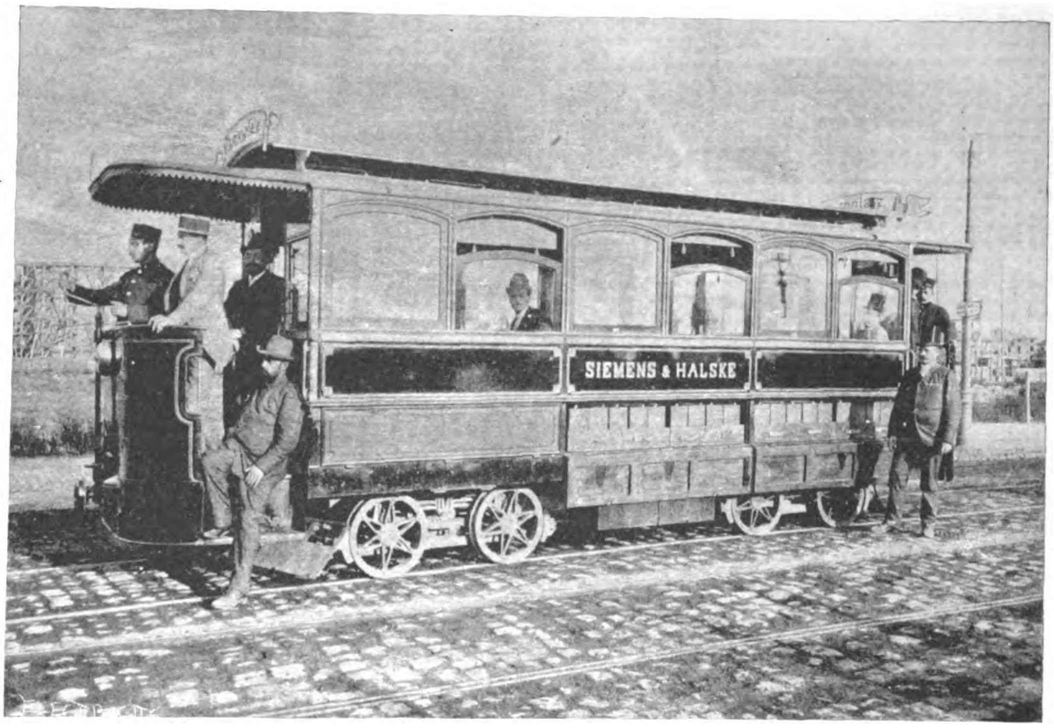
"With the four-wire six voltage system of distribution in a shop we can take out all countershafting, belting, pulleys and gears, if desired, and place a motor upon every tool, which we can operate in either direction at any automatic speed desired. Lathes, planers and all tools can be perfectly operated, and by getting rid of all countershafts and belts we can introduce the greatest of modern tools, the traveling crane, which we will also operate from our general system. We can also readily operate ventilating fans, hoists, elevators and factory tramways from the system."

The great storm in the east, which occurred last Monday, has wrought havoc with the poles and wires and outdoor electrical construction of all sorts. It would seem that nothing short of masonry pillars or iron bridgework can render overhead construction strong enough to stand all conditions of weather.

THE SIEMENS AND HALSKE STORAGE BATTERY CAR.

The accompanying illustration represents the storage battery car exhibited by Siemens & Halske at the Frankfort Exhibition. The car body is mounted on two four-wheeled trucks, each provided with a 15 h.p. double reduction motor. These reductions are made by means of sprocket wheels and chains, to lessen the noise occasioned by the usual cog gears, and but one of the two axles in each pair is driven. The second pair of wheels, not driven, are flexibly connected to the motor frame to enable the car to round curves.

The battery employed is the Tudor system and consists of 162 cells weighing about 2,200 pounds. The total weight of the car without passengers is given as 17,600 pounds, and its carrying capacity 40 passengers. Three sets of cells of 54 in series are arranged in parallel with each other, each set giving an electromotive force of about 115 volts. The battery is said to last for about five hours continuous run where grades are not encountered. The Tudor cell is of the Plante type and consists of a leaden support grooved on both sides with V shaped recesses so that a transverse section across these grooves gives the appearance of a two edged saw. These corrugations are about one quarter inch deep and in the old style were filled with the active material by means of hydraulic pressure. The newer plates, however, are simply cast and formed by the current after Plante's original method. One of the old style plates (positive) formed by hydraulic pressure, carefully enclosed in a handsome case with glass cover was exhibited at the exposition. This was said to have been in constant use for six years.



The Siemens and Halske Storage Battery Car.

KIND WORDS FOR ELECTRICITY.

Mr. W. H. Preece says, in a letter to the editor of Electricity: "I receive your paper with great pleasure. It is very well conducted and I wish you every possible success in your new venture."

It is proposed to use electricity for the disinfection of ships. By the electrolysis of sea water chlorine gas is liberated, and the same effect—that of the oxidation of the noxious substances—produced by chloride of lime, results. The gas will be carried in pipes from the electrolytic bath to the various portions of the ship.

A carman was recently killed in New York by being jammed up against a telephone pole by a runaway horse. The physician who attended him testified that he died from the injuries thus received and from asphyxia, but the intelligent jury, that bulwark of our liberties, rendered a verdict of *death from electricity*.

ELECTRICITY.

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The Berliner Microphone Patent. More than fourteen years ago—on June 4, 1877—Emile Berliner filed with the Patent Office an application for letters patent on a "Combined Telegraph and Telephone." Last week a patent for this invention, embodying very broad claims, was issued to the American Bell Telephone Company. This is the explanation of the newspaper rumors to which we referred last week, about the extension of the Bell patents. That those who are "on the inside" used their knowledge of the approximate issuance of the patent to advantage is told by our Boston correspondent this week, who refers to a large demand for Bell stock from Washington well in advance of any definite news of the Berliner patent. The claims of this patent are so broad that they practically cover every known form of battery transmitter, and all species of microphone now come within the scope of the Berliner patent. According to the best history of the litigation in the case, Edison, Irwin and Berliner have been in interference over the invention for about twelve years. Edison was disposed of two years ago, but the second interference was still kept up until the Berliner case emerged triumphant from the ordeal about three weeks ago. It is said by some who profess to know, that the Berliner patent has a greater commercial value than the original Bell patent; but this is decidedly open to question. As pointed out by our enterprising contemporary, *The Electrical Engineer* (which published with its issue of last week a supplement giving the gist of the specification and a brief history of the case), it is doubtful, in view of the circumstances of the long delay in its issue, whether the United States Courts would sustain the patent to the extent of permitting its owners to enjoy protection for the next seventeen years. Of course, the Berliner patent gives the American Bell Telephone Company an additional bulwark with which to protect their control of the telephone industry; but in all large cities the business is in such a position that competition would be almost impossible were all the telephone patents to expire to-morrow.

* * *

The World's Electrical Congress. It is very natural that all American electricians should feel deeply interested in the projected World's Electrical Congress. It is to the last degree unnatural and unseemly that the electrical journals should squabble about the question as to under whose auspices the congress should be held. Few of those who have taken any active part in the advancement of electrical science in this country would hesitate a moment, if any particular society is to be chosen, in adjudging the honor to the American Institute of Electrical Engineers. It has been very clearly and authoritatively pointed out, however, that in order to give the congress the truly international and official character which should be the first feature of it the invitations to foreign delegates should be sent by the United States Government. The matter at present really rests with the Department of Electricity of the World's Columbian Exposition, and with the information at the disposal of the Department, we have no doubt that the preliminary organization of the congress will be satisfactorily provided for. Meanwhile it cannot give a good impression abroad if our contemporaries persist in quarreling over this question of preliminary organization. One of the electrical journals published in Chicago, *The Western Electrician*, is a flagrant offender in this respect. A recent editorial, in which such expressions as "unparalleled audacity" and "effrontery" (on part of the Institute), and "impudent and snobbish editorials" are picturesque features, is devoted to a too fervid championship of the action—by no means well defined so far—of the exposition authorities. The exposition authorities may well ask to be saved from their friends if such writing as this is intended to uphold them. The warm interest which our irascible contemporary manifests in the Electrical Congress is all the more remarkable from the fact that as a technical journal it has neither standing nor authority, and none of those connected with it is even suspected to have had any scientific training, or to be an active member of any scientific society.

* * *

The 1893 Congress Abroad. It was very evident from the report of Mr. Hornsby, the energetic secretary of the Department of Electricity of the World's Columbian Exposition, that great interest is felt in Europe in the proposed electrical congress. As we point out above, American electricians are keenly interested in the subject and so much zeal has already been displayed in various quarters that some tact and management will be necessary to start the preliminary organization in the right lines. Meanwhile nothing can be gained by ebullitions of spleen on the part of the technical press, and much harm may be done by such misguided articles as that referred to in these columns if they should unfortunately happen to get out of this country. In proof of the very earnest manner in which the British electricians are taking up the question of the World's Electrical Congress and the Exposition generally, we quote the following from a letter just received from Mr. W. H. Preece: "I quite sympathize with the movement and will do all I can to further it. I think myself that it ought to be a great success. We have a splendid commission here who are working with a will, and we are going to form a very large electrical committee with all our principal men on it. I fancy that we shall come over very strong, and the idea is to have a meeting of the Institution of Electrical Engineers in Chicago; perhaps a joint meeting with the American Institute can be brought about."

* * *

"No Electricity." Those who travel in surface cars are occasionally compelled, for want of something better to look at, to read the advertising signs with which the cars are liberally provided. One of these signs now to be seen in many street cars, while it describes something which is not electrical and distinctly disclaims any connection with anything electrical, conveys a peculiar compliment to the electrical industries. The precise nature of the appliance advertised is immaterial; it is a mechanical appliance and a useful one, and a well-regulated household should certainly be provided with it. The description sets forth what it will do, how it is operated and how it is *not* operated. In large red letters is the announcement "no electricity." What more delicate and yet pointed compliment could an electrician desire than that simple announcement? The inference is that to-day almost everything is run by electricity; here is something that is not, but in order to make quite sure that the public shall understand that, the statement is made specifically that there is no electricity. A few years ago that suggestive notice would have been quite unnecessary and superfluous. But to-day electricity has pervaded everything, and when a man has the temerity to place on the market an appliance which is not operated electrically he finds it necessary to state conspicuously, in red letters, "no electricity."

* * *

Government Telegraphs. In the December *Cosmopolitan* Mr. Edward Everett Hale devotes his monthly article on "Social Problems" to a plea for government control of the telegraph. His arguments are curious, likewise, in places, his English. He holds that because the government runs the postoffice well, and its employees are civil, the government ought also to run the telegraph. But Mr. Hale does not make out much of a case for the postoffice, and as for the civility of its employees we know very well that everybody is not so fortunate in his experience as Mr. Hale has been. If the telegraph under the government gave business men no better service than the postoffice does, then business men would curse the day on which the telegraph passed into the hands of the government. Take for instance the mail service between New York and Chicago. The quickest time in which a letter and its reply can pass between those two points is five days, and the average would be nearer six, as the mails are often delayed. Yet if a man have important business to transact he can make the round journey, and spend from eight to fourteen hours in either city, within about sixty hours. The local mail service in and about our great cities is notoriously inefficient. Government control of the telegraph can never be a success in this country until the "spoils" system is eradicated from politics. If the organization of a telegraph system of the magnitude required by the United States were broken up and changed every four years the service could never be an efficient one. Of that there can be "no possible doubt whatever." Government management of the telegraph has been

eminently successful in Great Britain, but all officials of the department are permanent, the postmaster-general being the only one who goes out with the cabinet, and he has very little to do with the telegraph division of the postoffice business. The technical organization of the British telegraphs is on a scale that the Western Union Company never even dream of, and if the United States Government were to take over the plant of the Western Union it would be a long time before a similar organization, capable of dealing with that plant as it needs to be dealt with, could be organized. We fear that the day is not yet come for government control of the telegraph in this country.

GAS EXPLOSIONS IN SUBWAYS.

The ventilation of subways and manholes in Chicago was the subject of a conference in Commissioner Aldrich's office one day last week. An ordinance was recently introduced by Alderman McAbee to require the companies using conduits connected with manholes to ventilate the manholes by having the covers removed for the space of one hour out of every twenty-four. The ordinance was referred to the commissioner and City Electrician Barrett for a report, and it was on their invitation that representatives of the companies using the underground conduits assembled.

The discussion was general, but the results were indefinite. Professor Barrett favored the McAbee ordinance or something similar, holding that the only reliable way of ventilating the manholes is to lift the covers. The representatives of corporate interests were not prepared to agree with him, basing objections on the grounds of expense, and also disputing the effectiveness of the plan.

Mr. Parker, of the Postal Telegraph Co., said he had known of a case where an explosion occurred in a manhole the cover of which had been off for three or four hours. The plan followed in New York was discussed. There a steam apparatus is in use for forcing currents of air through the conduits, thus insuring perfect ventilation, but the expense of maintaining the plant is very great, amounting to $60,000 a year. Another meeting will be held next week.—*Chicago Herald.*

It is well known that gases, though light or heavy, and tending to collect at the top or bottom of a containing vessel according as they are lighter or heavier than the atmosphere in which they are liberated, also tend to diffuse and occupy the whole of the space regardless of their relative specific gravities. The law is that gases of different densities diffuse with a rapidity inversely as the square root of their densities. Thus Marsh gas (which may be taken as a type of the combustible gases we have to deal with), having a density of 8, would at first collect at the top, and carbonic acid, with a density of 22, would tend to collect at the bottom of a manhole containing air at a density of about 14.4. If the supply of these gases were not continuous, they would soon diffuse uniformly throughout the manhole and as large a proportion of the heavy carbonic acid would be found at the top, and of the light marsh gas at the bottom of the manhole as in the zones in which their specific gravities tended to arrange them. In a manhole, however, the problem we have to deal with is one where the supply of these gases is continuous, and if their addition is more rapid than their interdiffusive power there will always be an accumulation of the lighter combustible gases at the top and of the heavy carbonic acid at the bottom. Now a combustible gas such as illuminating or marsh gas is not explosive in itself and only becomes so when mixed with certain proportions of air, oxygen or chlorine.

Thus atmospheric air begins to be explosive when it contains about four per cent. of illuminating gas, reaches its maximum explosiveness when it contains about nine per cent. and for all proportions above thirteen and a half per cent. becomes non-explosive again. On account of the tendency of these combustible gases to rise and their tendency to diffuse, it is clear that there may exist in the same manhole at the same time all of the above conditions—at the top a non-explosive stratum underlaid by one of all degrees of explosiveness from the top to the bottom and succeeded again by another which will not ignite from a flame.

The action of chlorine associated with hydrogen and similar gases is unique. In the dark they do not unite but if exposed to the direct rays of the sun in the proper proportions they unite with explosive violence. Chlorine is one of the gases met with in sewers and manholes, and it is not unlikely that its presence, aided by a ray of sunlight that has found its way through some crack or crevice, is the cause of some of the hitherto unaccountable explosions that have occurred in subways containing wires carrying no current or through which no wires at all passed.

It is clear that if the ingress of gas be sufficiently rapid as to cause an accumulation at the top of the manhole, the removal of the cover for an hour would permit of the escape of that accumulation, but during the remainder of the twenty-four hours, diffusion would have distributed it so thoroughly throughout the chamber that it could not be thoroughly removed in the short time the cover was off unless its removal were assisted by artificial means. In case the proportion of gas were large, the simple diffusion of atmospheric air for one hour might convert it from a harmless to a violently explosive mixture, and thus the remedy become a source of danger rather than of safety as intended; and in case the diffused gases were in explosive proportions their specific gravity would be so nearly that of air as to prevent their ready escape in the time allowed. Then again, the removal of the cover, in case chlorine were present, might result in a violent explosion even in the absence of any flame or spark. It would seem, then, that the remedy proposed is not only not a radical one but under certain conditions may increase the dangers it is intended to obviate.

A rational method of ventilation would provide for the escape of the purer gases as fast as they accumulated and before they had become much diffused, and also provide for a continual change of the atmosphere so as to prevent the formation by diffusion of an explosive mixture. In some cases, connecting the manholes with lampposts, three inch iron pipes extending twenty or thirty feet up the sides of adjacent houses, or, better still, with chimneys or smoke stacks has afforded sufficient ventilation. In others, as in some portions of New York City, such means are totally inadequate and resort has been had to artificial ventilation by means of a forced draft.

The question of ventilation in coal mines where fire-damp or marsh gas is given off, has received attention from the earliest days, and is now very thoroughly understood. It seems strange, then, that in the face of all the experience in mine ventilation those who were responsible for the method employed in the New York subways should have adopted a method that no mining engineer would recommend, and turn their backs on the only one that experience has proved to be practical. In New York and Philadelphia recourse is had to a *forced* draft.

Experience in mine ventilation has taught that where the mine is small, and there is but little ramification of the underground workings and the air passages are large, a forced draft may be employed with some degree of success, but where the workings are extensive and intercommunicate, and the air passages are small, this method is wholly inefficient. It is evident that an electrical subway system, such as those employed in New York, Chicago and elsewhere, is a particularly aggravated case of small passage ways covering large extent of territory in which they form a perfect network. A less suitable method of ventilation for such a system than that obtaining in New York to-day, and suggested for Chicago, could scarcely be conceived. Forced draft should be prohibited on sanitary grounds alone, as tending to drive the gases into all houses connected with the subways. Would it not be well for the Commissioners of Public Works to consult with some experienced mining engineer before the question of ventilation of subways is finally passed on?

BOOK REVIEWS.

Central Station Management and Finance, by Horatio A. Foster. C. C. Shelley, 10 and 12 College Place, New York. Price $1.00.

In all new industries the first attempts to reduce the records of the operation to a system are apt to be crude and either too complex or to err on the other side by being insufficiently comprehensive. The latter fault is particularly liable to occur in those industries in which the profits are large and the necessity for rigid economy not therefore predominant. To this latter class of industries belonged electric lighting. We use the past tense advisedly for it no longer falls in that category, and the station manager, to be successful now must be a thorough business man as well as an electrician. He must allow no item of expenditure or income to escape him, and his accounts must be kept in such a way that he can at any time know how the different departments are being conducted, and where to lay the blame and how to correct troubles should they occur. The production of a set of blanks suitable to keeping a record of a complicated business, such as that involved in central station management, is usually a growth of many years, and in this particular instance this growth has not kept pace with the expanding business of electrical distribution. The result has been that on account of the dissimilarity in methods of keeping accounts, it has been difficult to draw comparisons between the practices that have obtained in different stations, and the public as well as the stockholders have suffered from lack of information through no unwillingness on the part of the managers to impart it, but from the fact that their systems of accounts did not enable them to state the information intelligently.

The little book before us is a very intelligent and withal successful attempt to rectify this trouble. It consists of twenty-nine blank forms with explanatory text which cover, without undue complexity, every department of central station management and finance. The author, Mr. Horatio A. Foster, is certainly well qualified for the task he has so successfully fulfilled by his long experience in central station management, and later as Special Census Agent for Central Stations. We think this book will be highly appreciated and the demand for the full sized blanks will undoubtedly be large when their existence and character are better known.

Prices of the various printed forms will be furnished on application to C. C. Shelley, Publisher, 10 and 12 College Place, N. Y.

A Practical Guide to the Testing of Insulated Wires and Cables, by Herbert Laws Webb. D. Van Nostrand Company, New York. Price $1.00.

This little work of 113 octavo pages was designed by Mr. Webb "to present in clear and practical form the ordinary every day work of the testing room, in other words, the rudiments of wire and cable testing, with a view to furnishing to the workers in the great fields of telephony, telegraphy, electric lighting and electric railroading a concise guide to the manipulation of a set of testing instruments."

In these days of electrical development the frequent testing of wires and cables has become of prime importance, and yet the number of workers

in electricity who are capable of doing their own testing is singularly small. This is largely due to the manner of handling the subject by previous writers and to the neglect of practical instruction in this branch of electrical work by our technical schools and colleges. It is not that we have not had good text books before; on the contrary, there are some excellent ones in the market, a type of which is the magnificent work of Kempe; but the authors have written for the theorist and the mathematician and have entirely overshot that vast army of practical workers in electricity in whose daily routine of work electrical measurements should form a prominent feature, but do not because the pabulum furnished by the best text books on the subject is entirely too technical for assimilation.

It has been said that he who makes two blades of grass to grow where but one has grown before, is a benefactor to the human race. It may be said with equal truth that he who enables two electrical measurements to be made where one was made before, has contributed largely to the advancement of electrical science, and this is just what Mr. Webb has done. With that rare faculty of imparting information so characteristic of the author, he has given us a guide to ordinary testing couched in such simple terms that all can understand, that will to many be the opening of a hitherto sealed book.

One word of caution must be given, however (which unfortunately need not be uttered in regard to many books in any science), and that is, that the descriptive matter and explanations are so clear that they are likely to lead to over confidence in the tyro. The analytical chemist will not trust a novice even in so simple an operation as the weighing of his precipitates, nor should the beginner expect, without previous training in the handling of instruments of precision, that his results will at once reach the requirements of nice work. This will only come with practice, it is a growth; but there is much of the ordinary work n a central station that a man of ordinary intelligence can soon master, and by the delicacy of manipulation thus acquired be intrusted from time to time with that requiring more and more precision.

Somebody has said that "Science is measurement." If this be true, and we think it an excellent definition, electrical work without measurement is not science. Working by rule of thumb has never yet resulted in much progress, and yet that is what the large majority of electrical artisans are doing to-day, condemned to remain in darkness because of their inability to grasp the meaning of the mathematical formulæ and technicalities of the better text books. To many of these, Mr. Webb's little book will be a ray of light that will guide them out of the depths to a higher and more useful plane.

The book opens with a simple explanation of the different tests, followed by six chapters descriptive of the various instruments used in such work, a thorough understanding of which is essential to their intelligent use. Then follow seven chapters more in detail, of the various tests, with illustrative examples; one on Connections of permanent set of testing instruments, another devoted to General remarks, Simple rules for connecting up, and Care of instruments, and the book closes with Suggestions as to records and reports of tests, with specimen test sheet blanks, which are the result of the author's wide experience in submarine cable, telephone, telegraph, and light and power line testing.

We regard this work a distinct and valuable addition to electrical literature. It fills a want long felt, but never before supplied, and we hope to see it in every electrical distribution centre and in the hands of all for whom Kempe is too technical. It must be borne in mind, however, that Mr. Webb's book is not intended to supplant these larger and more ambitious works, but is confessedly merely a stepping stone to their better understanding. N. W. P.

Two Exhibitions are shortly to be held in St. Petersburg. The first one is an Electrical Exhibition in connection with the Société Impériale Polytechnique Russe. The Exhibition will be held in the centre of the capital, and will be opened about the middle of December next, and closed on March 15th, 1892. The principal object of the Exhibition is said to be to enable the Russian Government to choose the best system, with a view to the inauguration of comprehensive electric lighting schemes in the principal towns of Russia.

The second Exhibition, which will be opened in the middle of April next, is an Exhibition of means and appliances for the prevention of fire. It will consist of six sections—viz., means to prevent fires, apparatus for the discovery of fires, engines and chemical compositions for extinguishing fires, appliances for saving life and aiding the wounded, means of transport for firemen and engines, and organization of firemen, statistics and literature.

SPECIFICATION OF THE BERLINER TELEPHONE PATENT.

United States Patent Office.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO THE AMERICAN BELL TELEPHONE COMPANY, OF BOSTON, MASSACHUSETTS.

COMBINED TELEGRAPH AND TELEPHONE.

Specification forming part of Letters Patent No. 463,569, dated November 17, 1891. Application filed June 4, 1877.

To all whom it may concern:

Be it known that I Emile Berliner, of Washington, in the District of Columbia, have invented a new and useful Improvement in Combined Telegraph and Telephone, of which the following is a specification.

My invention consists in a new and useful improvement in transmitters for electrically transmitting sound of any kind, of which the following is a specification.

It is a fact that if at a point of contact between two conductors forming part of an electric circuit and carrying an electric current the pressure between both sides of the contact becomes weakened the current passing becomes less intense - as, for instance, if an operator on a Morse instrument does not press down the key with a certain firmness the sounder at the receiving instrument works much weaker than if the full pressure of the hand had been used. Based on this fact I have constructed a simple apparatus for transmitting sound along a line of an electric current in the following manner.

In Figures 1 and 2 of the drawings, A is a metal plate well fastened to the wooden box or frame, but able to vibrate if sound is uttered against it or in the neighborhood of said plate. Against the the plate and touching it is the metal ball C, terminating the screw-threaded rod B, which is supported by the bar or stand *d*. The pressure of the ball C against the plate A can be regulated by turning the rod B. The said ball and plate are included in circuit with an electric battery, so that they form electrodes, the current passing from one of them to the other. By making the plate vibrate the pressure at the point of contact *a* becomes weaker or stronger as often as vibrations occur, and the strength of the current is thereby varied accordingly, as already described. By placing now, as is shown in the drawings, one such instrument in the station Fig. 1, and another instrument capable of acting as a telephonic receiver in the station Fig. 2, both situated on the same electric circuit in which a current is passing, (as shown by the wire connections following the arrows,) sound uttered against the plate of the instrument Fig. 1 will be reproduced by the plate of the instrument Fig. 2, for as the vibrations of the transmitter Fig. 1 caused by the sound will alternately weaken and strengthen the current as many times as vibrations occur, the diaphragm of the receiver will be caused by these electrical variations to vibrate at the same rate and measure. The latter vibrations being communicated to the surrounding air, the same kind of sound as uttered against the transmitter Fig. 1 will be reproduced at the receiver Fig. 2, or in as many other receiving-instruments as are situated within the same electric circuit.

It is not essential that the plate should be of metal. It can be of any material able to vibrate, if only at the point of contact suitable arrangement is made so that the current passes through that point. The plate may be of any shape or size, or other suitable vibratory media may be used—a wire, for example. Any other metallic point, surface, wire, &c., may be substituted for the ball. There may be more than one point of contact to be affected by the same vibrations. Both of the electrodes may vibrate, although it is preferable that only one should. If the uttered sound is so strong that its vibrations will cause a breaking of the current at the point of contact in the transmitter, then the result at the receiving-instrument will be a tone much louder, but not as distinct in regard to articulation.

I have also embodied my invention in and used it in connection with some other forms of apparatus.

In the drawings, Fig. 4 represents a detached view of the vibratory diaphragm, showing its relative situation to the poles of the galvanic current. Fig. 3 represents a view of a complete apparatus; Fig. 5, a view of the diaphragms arranged to receive and transmit the sound waves; and Figs. 6, 7, and 8 modifications of the vibratory diaphragm.

In the drawings, the letter A represents a diaphragm or plate of thin metal, of limited conductive capacity, such as iron, steel, German silver, platinum, secured in the frame *m m* in the box F in any convenient manner.

The letter *y* represents a ring resting against one side of said diaphragm and capable of being made to bear upon the same with more or less force by means of set-screws *n*, in order that the tension of the diaphragm may be regulated.

The letter B represents a screw or pin of metal, pointed at one end and mounted in a cross-piece *d* in such position that the point will be in contact with the diaphragm A. The diaphragm A is connected with one pole of a battery by means of a wire a', and the pin or screw B with the other pole by means of a wire b'.

The box F of Fig. 3 is provided with a tube K, to which the ear of the operator may be applied, in order to hear the sounds produced by the vibratory diaphragm when the instrument is employed as a receiver, and a tube O, through which he can speak when employing the instrument as a transmitter, so that the operator is not in need of moving the instrument or moving his head while carrying on a conversation.

Instead of employing a single vibratory plate, as shown in Figs. 1, 2, 3, 4, and 5, in each instrument, two such plates may be employed, as illustrated in Fig. 8, said diaphragms being connected to the respective poles and in contact with each other at their edges, as shown in Fig. 8.

The diaphragm of my improved receiver or the diaphragm of any magneto-receiver (such as those described by Alexander Graham Bell in his Patent No. 174,465 of March 7, 1876, and in his Patent No. 186,787 of January 30, 1877) will receive a particularly strong shock at the setting in and sudden cessation of the current when a ticking sound will be heard from the plate; but a weakening of the current alone can also be observed most distinctly and accurately by making, for example, a connection within the same circuit by a wire and the blade of a knife *k*, Fig. 4. When scraping the wire end over the blade of the knife, this scraping is distinctly audible on the plate. Here the current is never entirely interrupted, yet the minute elevations and cavities on the blade, caused by the structure of the steel and which again cause minute alterations in the intensity of the current, are sufficient to shake or vibrate the plate with varying intensity, thus rendering again the same peculiar scraping noise. If, now, the plate of one instrument, as in Figs. 1 or 5, is vibrated by sound-waves (which happens whenever any kind of sound is uttered or is produced by musical instruments in its neighborhood) every wave or vibration that strikes the plate produces between the two sides of the contact a variation of pressure, which causes a variation of resistance at that point. and therefore a variation in the strength of the passing current, and if the sound is sufficiently strong it will break the circuit at said point of contact, the variations in the current thus produced causing similar vibrations in the plate of the receiving-instrument. The essential part of the apparatus is the point of contact, which must offer a resistance to the current.

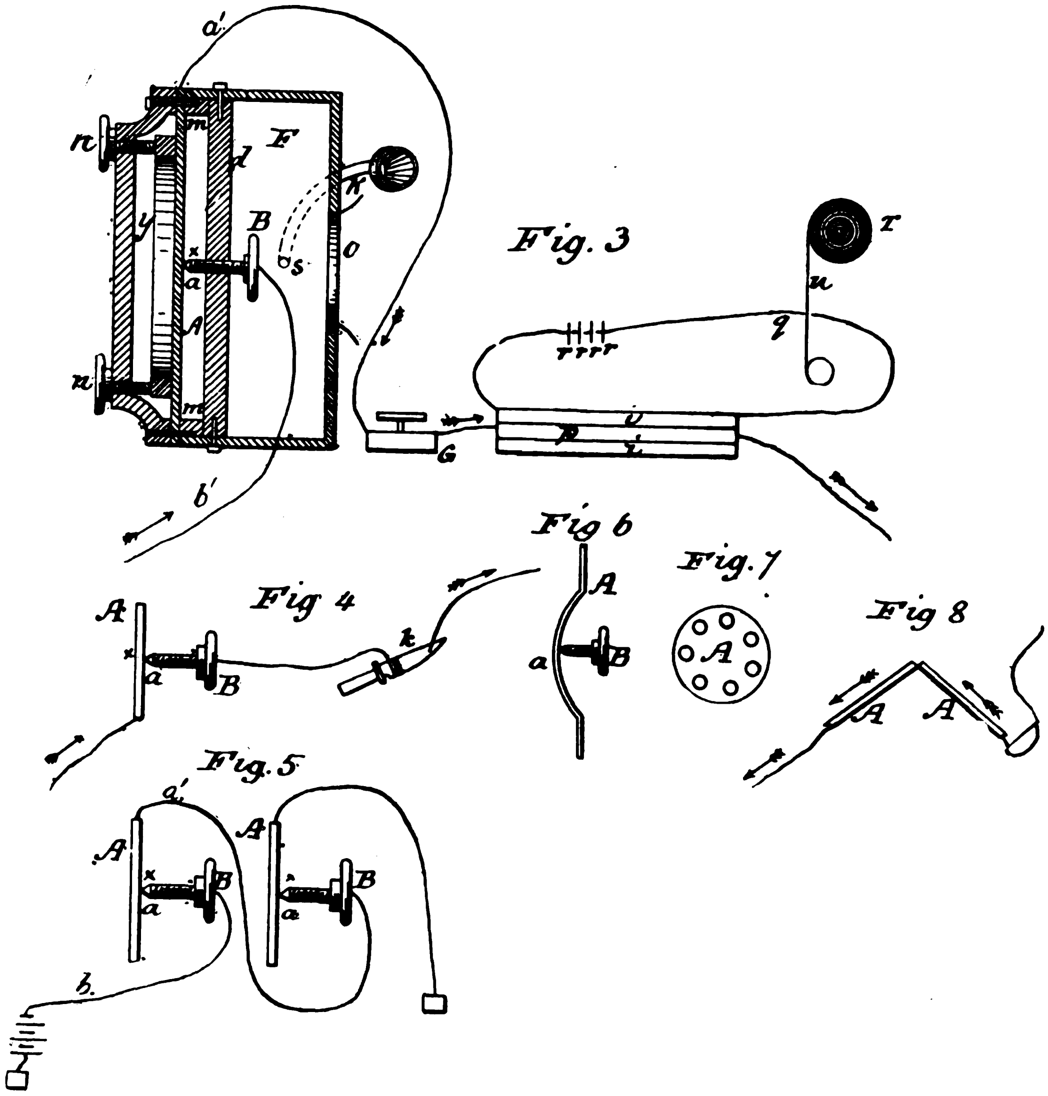
It is not necessary in the transmitting apparatus that the plate should be of conducting material, for any substance capable of vibration will answer, if only at the point of contact provision is made for the current to pass. It is sometimes convenient to use a vibrating plate in the form of a reflector, as shown in Fig. 6, for concentrating the sound, or the diaphragm may be provided with a number of apertures to disperse the sound as shown in Fig. 7. These apertures prove advantageous with strong sounds, particularly the hissing sounds, as while the sound waves are rushing toward the diaphragm, those touching the plate are repelled and partially destroy the following waves, just as sea-waves when forced against a cliff will be thrown back, destroying those directly behind. The holes permit most of the waves to pass to the other side of the plate,

making the vibration of the plates more perfect and even.

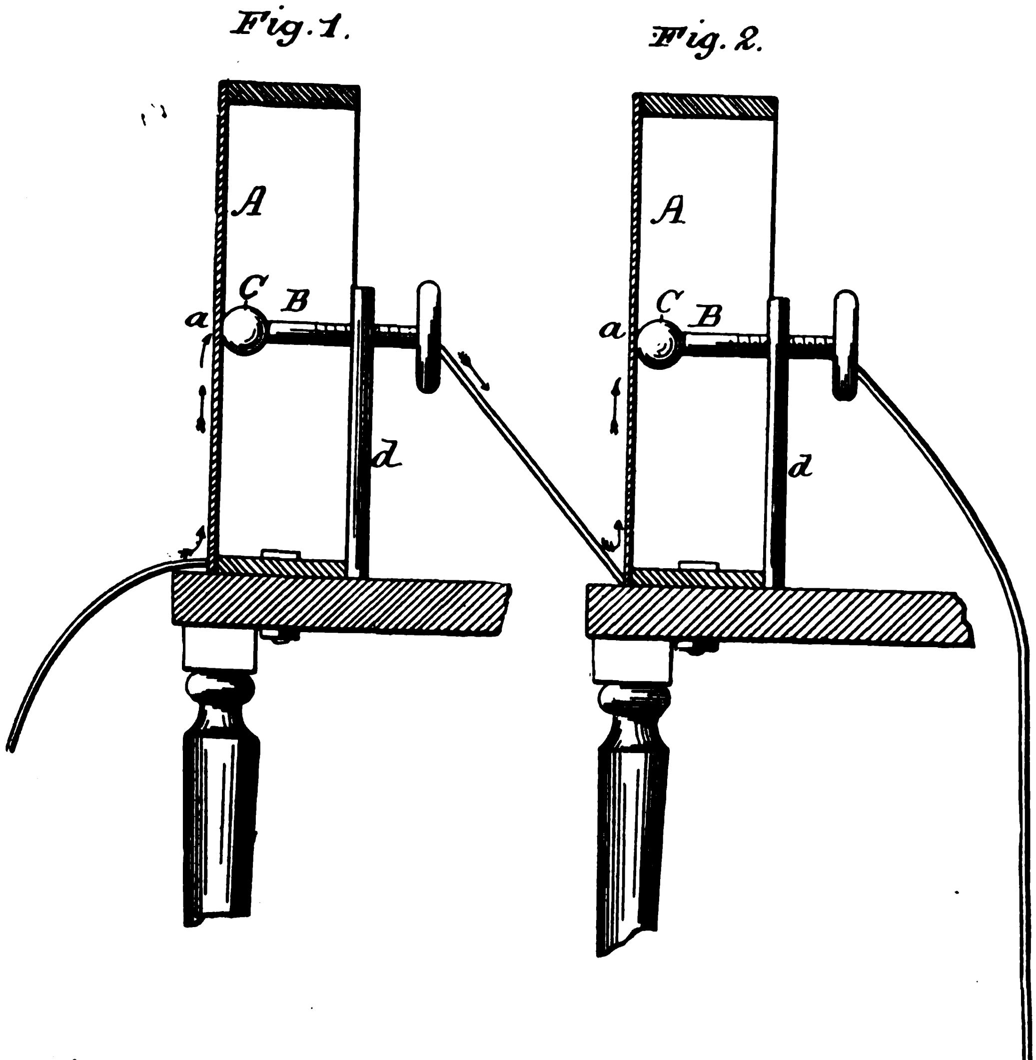
I will here describe a recording apparatus, which, however, I do not claim.

In Fig. 3, G is a galvanometer, which is located in circuit with the contact-pieces or electrodes A B, and which serves as a convenient means for ascertaining the adjustment of the contact-pieces of the transmitter, so that a current shall pass. *i p i* is a Ruhmkorff coil or induction apparatus. When a current passes through the primary coil *p* and suddenly is broken, a spark will rush over between the ends of the secondary coil *i i* at *q*. This spark is accompanied by a peculiar sound due to the electric discharge, and if we bring between the ends of the secondary the connecting points *r r r r* a spark will occur between each of them, provided they are near enough to each other, and the peculiar sound will be heard between each of them. I now arrange a strip of chemically-prepared paper or other substance *n* to be drawn by clock-work T between the ends of this secondary wire at *q*. Said strip can be prepared in such a way that each spark will produce a mark upon it. If, therefore, the plate A vibrates by sound, each vibration causing a break of contact will produce a spark at *q*, and the strip being drawn through, a succession of marks will be produced upon the strip according to the number of vibrations caused by the sound; but at the same time the sound which was uttered at the plate A will be heard from the sparks rushing over the points *r, r, r, r*, and *q*, because every spark produces one wave in the atmosphere in which it occurs, and a certain number of waves will therefore produce certain tones. Therefore the same sound which is uttered against the plate A will be heard from the sparks. The scraping of the wire end on the knife-blade *k*, as in Fig. 4, in the primary current will also be heard between the wire ends of the secondary current at *r, r, r, r*, and *q*. This permits a number of designs for a receiving apparatus within the secondary current. For instance, initials, ornaments, etc., consisting of a number of metal pins, can be constructed in such a way that whenever a tone is produced against the plate A a spark will rush over said metal pins, and at the same time their sound is produced will render the design visible in illuminated characters.

By making the person of the operator a part of the secondary circuit and discharging the sparks in the body in the neighborhood of the ear the sound will be more particularly apparent.



The Berliner Microphone. Figs. 3, 4, 5, 6, 7 and 8.



The Berliner Microphone. Figs. 1 and 2.

It will be observed that in Figs. 1 and 2 one of the electrodes presents a convex curvilinear surface like a rounded knob. This possesses some advantages, among which are ease of construction and durability, because it does not wear away the opposing electrode as much as a sharp one would, and when the contact with the vibrating body is made of such a form the freedom of the vibration is less interfered with.

I do not claim that I am the first inventor of the art of transmitting vocal and other sounds telegraphically by causing electrical undulations similar in form to the sound-waves accompanying said sounds. Neither do I claim that I am the first who caused such electrical undulations by varying the resistance of an electric circuit in which a current was passing.

I do not herein claim the novel form of vibratory-plate receiver which I have described, because that is a subject of claim in another application.

I claim –

1. The method of producing in a circuit electrical undulations similar in form to sound-waves by causing the sound-waves to vary the pressure between electrodes in constant contact so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit, substantially as described.

2. An electric speaking-telephone transmitter operated by sound-waves and consisting of a plate sensitive to said sound-waves, electrodes in constant contact with each other and forming part of a circuit which includes a battery or other source of electric energy and adapted to increase and decrease the resistance of the electric circuit by the variation in pressure between them caused by the vibrational movement of said sensitive plate.

3. The combination, with the diaphragm and vibratory electrode, of a rigidly-held opposing electrode in constant contact with the vibratory electrode, substantially as described.

4. In a telephone transmitter, a vibrational plate made concave for condensing the sound, substantially as set forth.

5. In a telephonic transmitter, a vibrational plate provided with one or more apertures, as and for the purposes set forth.

6. A speaking-telephone transmitter comprising a diaphragm or disk sensitive to sound-waves, combined with a rigidly-held but adjustable electrode in contact with the same, whereby the electric current is transformed into a series of undulations corresponding with the vibrations of said diaphragm.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of the subscribing witnesses.

EMILE BERLINER.

Witnesses:
J. A. RUTHERFORD,
JAMES L. NORRIS.

ANSWERS TO CORRESPONDENTS.

Subscribers to ELECTRICITY *are invited to make use of this column whenever electrical questions of general interest arise. Where apparatus is concerned, full details should be given. It will be the aim of* ELECTRICITY *to answer all legitimate queries of an electrical nature in as clear and untechnical a manner as possible, and thus to make this column a friendly guide to those of its readers who may desire such assistance. Inquiries should be accompanied by the full name of the writer—not necessarily for publication, but for our own information—and should be addressed to the Editor of* ELECTRICITY.

If the economy of operating an electric motor depends to a certain extent on the speed at which it is run, would not the gearless motor, which has lately been more or less adopted on many roads for street car propulsion and which must necessarily run at a slow rate of speed, draw more current than the ordinary reduction motors and thereby become less economical?

H. T. B., Montreal.

Yes. The energy exerted at any given speed may be represented by the product of that speed into the torque, and in a given machine the torque is nearly proportional to the current employed. On constant potential circuits, therefore, the energy consumed would be inversely as the speed. But the term speed, as here used, is not confined to either angular or circumferential; but is used to indicate the rapidity with which the lines of force are cut by the armature coils. This may be increased in two ways, either by increasing the diameter of the armature so that with the same angular velocity it will have greater circumferential speed, or by using a multipolar field, so that with the same circumferential speed of armature the coils will cut more lines of force in the unit of time. The torque, too, is proportional to the radius of armature, so that by properly proportioning all these elements, it would be theoretically possible to produce a motor that would run as economically at very slow speed as another one at very high speed. But in practice, especially in street railway work, the diameter of the armature is necessarily limited by the available space. Most if not all of the gearless motors used for this purpose are constructed on the lines laid down above, viz.: with as large an armature as possible and a multipolar field. The exigencies of the situation, however, do not permit of these features being carried far enough to produce a gearless motor that will operate as economically as one having single or double reduction gearing. It was hoped that the saving in cost of repairs, loss of efficiency and noise inseparable from reduction by gears would more than compensate for the disparity between the two styles of motors—a hope that we believe has not yet been realized in practice.

Will you please tell me how to construct an electric battery and what chemicals to use?

Also will you oblige me with information that will enable me to make a small electric motor?

C. S., Rodman, Palo Alto Co., Iowa.

A very simple, effective and inexpensive galvanic cell may be constructed as follows: Buy at any electrical supply house what is known as a "pencil" zinc. These are about 6¼ inches long and ⅜ inch diameter, have a binding post on one end and should cost about five cents each. Buy also a plate of battery carbon about 6 inches long by 2½ inches wide; this should cost about five cents also, and get about ten cents worth of No. 18 or 20 copper wire. Cut this wire into two pieces and fasten the end of one to the binding post of the pencil zinc, and the other to the end of the carbon plate. By boring a hole in the latter and threading the wire through, twisting it tightly on itself, a good connection can be made. Next procure a wide mouthed jar—a fruit jar will do—fill it about three-quarters full with a strong solution of ordinary table salt in water and stand the zinc and carbon upright in the liquid being careful that they do not touch each other at any point. If the two free ends of the copper wire are now connected together, a current of about one and one-quarter volts pressure will pass from the carbon to the zinc. This is sufficiently strong to ring an ordinary electric bell, to which it may be connected by placing the free ends of the wire in the binding posts provided for that purpose. The two ends of the wire should always be disconnected when the battery is not in use, as continued generation of current causes the battery to become very weak. Should it become weak from this cause, it will regain its strength almost entirely if the wires be disconnected and the cell be allowed to stand idle over night. A somewhat better cell is made by substituting sal-ammoniac for the table salt.

In regard to the construction of an electric motor, it would be impossible for us to give directions intelligently in these columns and we must refer you to the books for this information. The work "Electricity in the Service of Man" will give you a very clear description of what you want.

What book would you recommend to one who is desirous of learning as much as possible of electricity, theoretically and practically?

J. P. E., Wilmington, Del.

This is a very difficult question to answer, as the language is singularly deficient in really good elementary text books. Then again in recommending a book we should be largely governed by the previous training of the enquirer. A book that would meet the wants of one familiar with mathematics would evidently not meet the wants of one not so trained and vice versa. Without knowing your situation in this respect we would on general principles suggest the following:

Atkinson's Dynamic Electricity, price $2.00.

Elementary Lessons in Electricity, by Sylvanus Thompson, price $1.25.

Electricity in the Service of Man, translated from the German of Von Urbanitzky, price $6.00.

All of these can be furnished by ELECTRICITY on receipt of price. The last book is a large work, written in very popular style, and deals with all the important applications of electricity up to the time of publication.

FROM NEWS CENTRES.

MONTREAL.

MONTREAL, Nov. 19. It is hardly probable that an elevated road would prove practicable in Montreal. New York and Brooklyn are the only two cities in the world successfully operating such a system. In those cities the number of passengers carried daily by this means is enormous. Montreal, on the other hand, is a very much smaller city, and the question arises whether, taking into consideration the cost of construction, equipment, and the damages to property, which would necessarily be large, the road would carry a sufficient number of passengers to make it pay. It was mentioned in a previous letter that the city aldermen had been presented with a description of the Davis Electrical Cable Elevated Railway, which could be constructed for $25,000 per mile. It might be well to add that when Mr. Davis was interviewed on the subject, he was obliged to admit the impracticability of constructing the road alone for any such sum, not to mention the excessive damages which would naturally result. If the road were likely to carry a large number of passengers it might prove practicable to build it. The chances for the surface road are still improving, and several new lines have been proposed, branching out into various parts of the city where the needs of quick transit are greatest.

A private electric light plant has recently been successfully established in Quebec, and has given very gratifying results. It was installed on the premises of Z. Paquet, a dry goods merchant in that city, under the supervision of Mr. W. B. Shaw, electrician for T. W. Ness' electrical supply house, Montreal. The dynamo is a "Wenstrom," furnished by the Ball Electric Light Co., Toronto, and is of the four-pole type. It is of remarkably slow speed, giving 225 amperes of current at 110 volts, with only 485 revolutions per minute. Swan and Zurich lamps are used. Four green lamps illuminate the star-shaped windows of the tower in the Company's new building, while the two newel posts at the foot of the stairs on the ground-flat are each supplied with three light-fixtures carrying red, white and blue lamps. The switch-board is of polished natural cherry, complete with ampere meters, volt meters, and four double pole "Hill" switches, controlling four different circuits. The capacity of the dynamo is 450 lights, of which 280 are now running, and the remainder will be placed in the old premises after alterations next spring. The engine and boilers were supplied by Carrier Laine, of Levis, P. Q. The engine is also running a 35-light Thomson-Houston arc machine, the lights from which are distributed throughout the ground floors and in front of the premises.

A private plant at Belding, Pauls & Co.'s, silk manufacturers in Montreal, has recently been successfully established. It is of 800 lights, and operates two 25 kilowatt Edison generators.

The Edison General Electric Co. has lately installed two electric percussion drills, generators and other electrical mining appliances in the New Rockland Slate Mine, at Richmond, P. Q. The drills are capable of drilling a 2½ inch hole, 14 inches deep.

Until recently the modern perfected form of the phonograph was almost unknown in Montreal, but, stimulated by the exhibit at the Electric Light Convention, the firm of Holland Bros. and Young obtained the Canadian agency. A commodious parlor has been fitted up on one of the principal streets where the instrument is exhibited.

Two electric passenger elevators are in successful operation here, and a third is to be put in one of the new science buildings of McGill University. The largest is in use at H. & N. E. Hamilton's dry goods establishment. It is operated by a 15 h. p. Edison motor. The other is in use at the Sun Life Insurance Co.'s building.

A large number of the science freshmen of McGill University intend to avail themselves of the opportunity of taking the new course in electrical engineering recently established through the beneficence of Mr. W. C. McDonald. It is interesting to note what a rush there has been of young men to take this course. It points very strongly to the increased interest taken in electrical matters in Canada, and also to the fact that Canadians are not slow in appreciating the opportunity of taking up a life study offering such a great field of work.

H. T. B.

BOSTON.

BOSTON, Nov. 21.—The subject of life-guards or fenders on the electric cars of the West End Railway Co. continues to engage a large share of attention from the city aldermen who have had another lively discussion on the subject this week. They seem determined to keep the matter going until the directors of the company satisfy them that they are using the safest device to be found.

On Thursday evening Mr. Maurice Oudin, of the Thomson-Houston International Co., gave a very interesting address on "Electro-motive Force, with special reference to the extension of Ohm's Law."

A 250 h.p. generator is being supplied by the Thomson-Houston Electric Co. to the People's Light and Fuel Mfg. Co. Moline, Ill., and will be used for electric motor service.

The Thomson European Electric Welding Co. have issued circulars to stockholders, in which it is stated that after the payment of the dividend of $25 per share, the Company have assets of $80,000 cash, all of the continental patents and the stock in the British Company. It is the intention of the directors to sell the patents and stock in treasury, and an agent is now in London for that purpose.

It had been noticed for a week or two past in Boston financial circles that a big demand for Bell Telephone stock was received from Washington and people were curious to know what it meant. On Tuesday last the long delayed patent for the Berliner transmitter, belonging to the Bell Telephone Co., was issued, after the application had been filed 14 years. Instantly on receipt of the news in State Street, Bell stock went up until it stood at least 30 points higher than a few weeks ago. Remembering the rush of recent orders from Washington, some one put the query in a

morning paper. Can it be that there is a leak in the Patent Office?

The New England Telephone and Telegraph Co. is about to erect a new central building in Dorchester, which is to cost $80,000. The company is extending its underground system in Portland, Me., and Worcester, Mass., and has completed a new trunk line to Brattleboro and Bellams Falls.

Barre, Vt., is to have an electric plant of sufficient capacity to light several adjacent towns.

Through a lack of interest shown by its members for some time past the Boston Electric Club may be considered practically *non est*. The committee of management has notified the members of the necessity for vacating the rooms and disposing of the property of the club. It is still intended to perpetuate the club in some way, and so it is proposed that occasional dinners be held, papers read and topics discussed. Those who have always had the interests of the club at heart regret the necessity for such a step, but any alternative course was found to be impracticable.

W. S. K.

ELECTRIC LIGHT APPARATUS OF THE EASTON ELECTRIC COMPANY.

The Easton Electric Co., of Brooklyn, N. Y., claim for the apparatus manufactured by them many distinctive features which are of general interest. Their constant current dynamo (Fig. 1) is specially designed and constructed so as to avoid overheating, and this is accomplished without the intervention of the automatic regulator common to other dynamos. The magnet coils of the dynamo are so proportioned as to be saturated by seventy five per cent. of the normal current, while the armature does not become saturated with less than five times the normal current in its coil, and is also relatively a powerful magnet compared to the field coils, the action of which it opposes in the well known manner. A sudden tendency to increase of current therefore produces no appreciable effect, as the field magnets are already saturated. With this dynamo it is possible to cut lamps in or out of circuit to any extent without injuring the machine. A peculiar feature of the dynamo is the use of fusible connections between the armature coils and the commutator segments, to prevent damage to the armature through imperfections in the commutator. The method of mounting the armature on the shaft (shown in Fig. 2) is peculiar to the Easton dynamo, and is very effective in preventing slip and securing ventilation.

The constant potential dynamo (Fig. 3) is of the "iron-clad" type. The armatures are wound with but one layer of wire, and all sizes that have a capacity of more than 120 amperes have but one turn per section. These machines are compounded or over-compounded to any desired extent to compensate for the "drop" in line, and when properly erected are automatic in regulation.

A small rheostat is provided to compensate for slight variations in power, speed and heating of the shunt coils of the dynamo. If speed is constant and the dynamo is warmed up, the rheostat is no longer necessary to regulation. The bearings are automatically lubricating, as in the constant current dynamos.

Two distinct types of arc lamps are manufactured by the Easton Co., designed respectively for use on constant current and constant potential circuits. The one for constant current (Fig 4) is a balanced lamp, or one in which the feeding is governed by the different pulls of solenoid coils in the main circuit and in shunt around the arc. The lamp for constant potential has a "universal" movement, or one in which the feeding is governed by the pull of the shunt solenoid, balanced against the weight, which renders the lamp independent of the amperage. The universal lamp, when once adjusted for any current, may be used with different strengths of current, and will operate without adjustment as soon as the carbons burn to the shape which the new strength of the current will produce.

The "X" arc lamp is a combination of the balanced movement and universal gearing and is adapted for use on circuits with incandescent lamps, or motors. These lamps may be operated two in series on 110 volt circuits, or eight in series on railway circuits of 500 volts.

The Easton system also includes a simple and effective ammeter, or indicator (Fig. 5.), switchboard attachments (Fig. 6.), pole fixtures, suspension hoods and other devices which go to make up a complete working system.

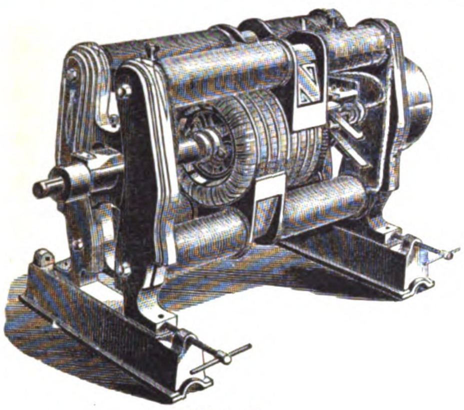


FIG. 1.

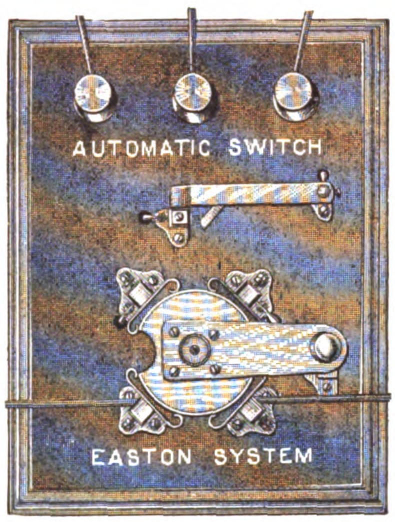


FIG. 6.

FIG. 5.

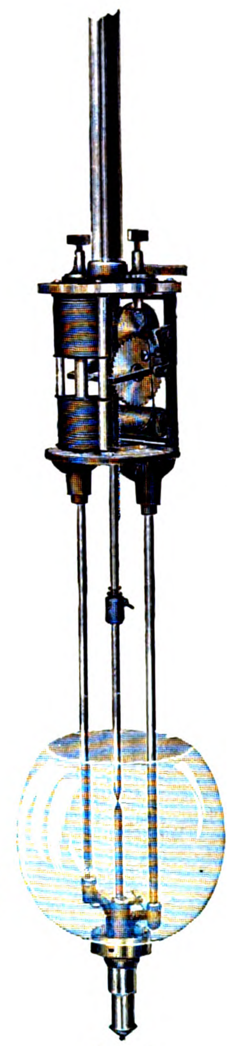


FIG. 4.

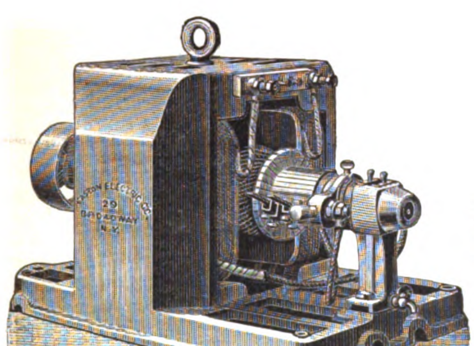


FIG. 3.

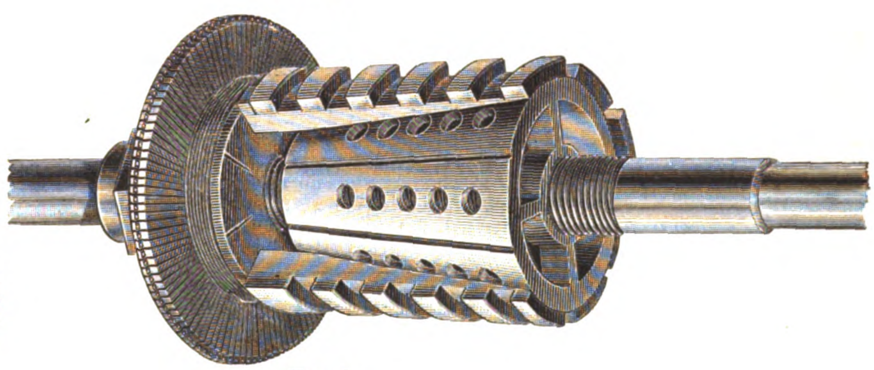


FIG. 2.

H. WARD LEONARD & CO.

The above firm have just issued a little pamphlet of testimonials and references regarding their past work.

In a prefatory note they state that since their company only began business on Sept. 1st, 1891, they cannot refer to installations made by themselves. Notwithstanding this statement, however, they do print a letter from the Edison Electric Illuminating Co., of Brooklyn, which speaks in the highest terms of the operation of the electric elevator equipped with Mr. Leonard's new system by this company.

The first twelve pages of the pamphlet are occupied with unqualified endorsements from architects and others, of the work done by Leonard & Izard, of Chicago, of which firm Mr. Leonard was the chief. Then follows a list of electrical installations made by them, many of which were of very large size, and the closing pages are devoted to newspaper clippings favorable to the new firm. One cannot read this pamphlet without being convinced that work entrusted to the them will be placed in thoroughly competent and responsible hands.

A NEW HOT-WIRE VOLTMETER.

Messrs Queen & Co., of Philadelphia, are just putting on the market a new "hot wire" voltmeter which possesses many valuable features. It is the invention of Mr. Frank Wagner, of the University of Michigan, and, like the well-known Cardew instrument, depends for its action upon the expansion of a stretched wire which is heated by the passage of a current due to the E. M. F. to be measured. The hot wire in this case is only about five inches long, and its elongation is greatly magnified by a long aluminum index. In series with the wire there is introduced an extra resistance wound non-inductively. By altering this re-

WAGNER QUEEN VOLTMETER.

sistance, the instrument may be adjusted to different ranges. As the wire employed is very thin, it assumes its maximum temperature almost at once, thus making the instrument exceedingly deadbeat. It is direct reading for both alternating and direct currents, and the instruments are now manufactured in two ranges with maxima of 55 and 125 volts respectively, the scale being graduated in single volt divisions. The scale divisions are about ½-inch each in the 55 volt instrument, and about 1-24-inch each in the 125 volt instrument. A mirror is inlaid in the scale to avoid parallax in taking readings. Aluminum is employed in construction wherever possible, resulting in an instrument that weighs but 22 ounces complete. It is also exceedingly compact, the outside dimensions being 7¾ inches by 4 inches, by 2 inches, thus well adapting it for transportation.

PERSONAL NOTES.

John R. Fletcher, of the firm of Fletcher & Fletcher, Cleveland, Ohio, made a short stay among his many friends in Chicago last week.

Mr. H. C. Spaulding, who is well known through his connection with the Thomson-Houston Electric Co., and recently manager of the Thomson-VanDepoele Electric Mining Co., has severed his connection with that company and has gone into business for himself as consulting and constructing electrical engineer, his office at present being in Exeter, N. H.

Mr. I. W. Sprague has been appointed manager of the Thomson-VanDepoele Electric Mining Co. In the past Mr. Sprague has done good work for his company and his friends warmly congratulate him on this well deserved recognition.

Mr. E. A. Desmarets has been appointed New York representative of the W. S. Hill Electric Co., and opened an office at 136 Liberty street. The outlook for business in the metropolis is good.

Mr. E. Wilbur Rice Jr., general superintendent of the Thomson-Houston factories, left home last week for Colorado Springs. He will be gone about three weeks and will visit several of the western branch establishments of the Thomson-Houston Co.

Mr. H. L. Rogers, agent of the Thomson-Houston Electric Co., has within the last two weeks closed contracts for three complete central station plants, which he thinks is not a very bad record.

Mr. N. T. Starkey, for some time past in charge of the New England electric railway business of the Edison General Electric Company, has severed his connection with that company and is now identified with a street railway syndicate. Mr. C. C. Pierce, who has had large experience with the Edison Company, will succeed Mr. Starkey.

INCORPORATIONS.

Ypsilanti Electric Company, Ypsilanti, Mich.: capital stock, $25,000; promoters, Brainard Rorison, M. V. Rorison, of Ft. Wayne, Ind., and A. C. Rorison, of Ypsilanti, Mich.

DesMoines Water Power and Electric Company, Des Moines, Iowa; capital stock, $225,000; to purchase the Des Moines water power plant, also the establishment and maintenance therewith of an electric plant; promoters, Lowry W. Goode, Fred D. Goode, C. E. Meade, DesMoines, Iowa.

B. & S. Storage Company, Sioux City, Iowa: capital stock, $1,000,000; manufacture, buy, sell, etc., storage batteries, dynamos, electrical appliances; promoters, E. M. Dunbar, C. S. Wallis and J. Y. Bradbury, all of Sioux City, Iowa.

COMMERCIAL PARAGRAPHS.

The new annunciator of the Union Electric Works, Chicago, has several novel features. It has no springs to get out of order. The armature is suspended by screws from the poles of the magnet. The latch falls and moves the needle by gravity and the replacement mechanism drops back by its own weight. Chicago electrical men who have seen it are greatly pleased, and it is meeting with an unexpectedly large sale. In price it can compete with any annunciator on the market.

The Electric Appliance Company opened their well appointed store at 242 Madison street on the 17th inst., and are now ready for business. Their stock is well assorted and complete and with large shipments now on the way they will be in perfect running order in a very few days. As the company was organized but a few weeks ago this speaks well for their enterprise. Within the short period of two weeks they have secured their building, fitted up their offices and store, and put in a well assorted stock. Paranite wire, the Company's leading specialty is already attracting attention and receiving general approval. The merits peculiar to Paranite were referred to in the last issue of Electricity.

The Consolidated Electric Mfg. Co. has been appointed selling agent for the well known Habirshaw wires, and quotes New York prices in Boston. Corthell's Adjustable Extension for electric lamps will also be handled by the same company.

The demand for the Schæfer incandescent lamp is increasing so rapidly that great difficulty is experienced in filling orders. Mr. C. W. Cartwright, general sales agent for Boston and districts, reports having closed several large contracts with various companies for their entire supply for a year or more. The other specialties of the prosperous Germania Electric Co. find favor everywhere.

The Thomson-VanDepoele Electric Mining Co. has a contract for a combined lighting and hoisting plant at the works of the Paymaster Mining Co., Southern California.

The new electric light support, recently placed on the market by R. Hollings & Co., of Boston, has proved an instant success. It has only been advertised for two weeks or so, yet the inquiries and orders from all parts of the country foot up well, and quite a staff of men is kept busy turning out large quantities.

Mr. Howard Challen, of No. 10 Spruce street, New York, publisher of labor saving records, has added another to his list in his Engineers' Log Book. This consists of printed blanks bound in book form, giving month, day of week, average pressure per gauge, hours run, revolutions, vacuum per gauge, piston speed, indicated horse-power, etc., and furnishes a convenient means of keeping a complete record from day to day of the performance of the engine. The Engineers' Log Book will undoubtedly be found useful by those who are sufficiently enlightened to appreciate the necessity of keeping systematic accounts in the engine room as well as in the office.

The Schneider Combination Car Co., of Chicago, are constructors of a novel style of street car which can be changed in a few minutes from an open, or summer car, to a closed, or winter car and *vice versa*. By their system, old box or open cars can be rebuilt to a combination car, available for both, thus practically making a single equipment do the duty of double the number of cars. This combination car will be valuable on all street railways, but particularly so on smaller roads, from which the revenue derived is not sufficient to warrant the purchase of both kinds of cars.

The Dearborn Drug and Chemical Co., Rialto Building, Chicago, make a specialty of supplying steam users with boiler solvents especially adapted to the water they use in their boilers. In order to introduce these solvents they invite all steam users to forward to them a sample of the water used in their boilers. Of this sample (about a gallon is sufficient) the Dearborn Company make an analysis and forward a report, free of all charge, recommending the proper solvent to prevent scaling and pitting or grooving of the boiler. The following is a specimen report of an analysis of Lake Michigan water, made by the company.

1. Silica	.400	grains per gallon.
2. Oxides of Iron and Aluminum	Trace.	
3. Carbonate of Lime	4.467	" " "
4. Carbonate of Magnesia	3.012	" " "
5. Chloride of Sodium	.430	" " "
6. Sulphate of Soda	.260	" " "
7. Sulphate of Lime	1.850	" " "
Total Solids	10.449	" " "

"10½ grains to the United States wine gallon of 231 cubic inches. We consider this a very fine water to use in steam boilers. It will require an evaporation of over 700 gallons to leave one pound of scaling ingredients in the boiler. This water will also cause a slight galvanic action, but can be successfully treated at a small cost."

ELECTRICAL PATENT RECORD.

Letters Patent Issued Nov. 17, 1891.

DYNAMOS AND MOTORS.

463,174. Armature for Dynamos or Electric Motors. Barron D. Southard, Chicago, Ill., assignor to the Chicago Electric Motor Company. Application filed March 2, 1891.

463,242. Dynamo Electric Machine. Martin C. Burt, Chicago, Ill. Application filed Jan. 21, 1891.

463,314. Alternating or Pulsating Current Motor. Ludwig Gutmann, Pittsburgh, Pa. Application filed April 7, 1890.

463,315. Power Storm Mechanism for Electric Locomotive. James H. Hackett, Sterling, Kan. Application filed Oct. 22, 1890.

463,356. Electric Locomotive. Sidney H. Short. Application filed April 8, 1891.

463,359. Motor Car for Electric Railway. Thomas E. Adams, Cleveland, Ohio, assignor to the Brush Electric Co. Application filed May 28, 1890.

463,596. Motors for Sewing Machines. William H. Clayton and Robert Duncan, Louisville, Ky.; said Clayton assignor to Charles E. Powell. Application filed Oct. 23, 1889.

ELECTRIC RAILWAYS.

463,136. Device for operating Railway Switches. Watson A. Brown, Rochester, N. Y. Application filed Nov. 12, 1890.

463,197. Electrical Conduit. John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Co., Chicago, Ill.

463,310. Crossing for Electric Railway Conductors. W. J. Silver, Salt Lake City, Utah. Application filed Feb. 2, 1891.

LAMPS AND ACCESSORIES.

463,154. Electric Arc Lamp. William Jandus, Cleveland, Ohio. Application filed Dec. 4, 1886.

463,595. Duplex Arc Lamp. Ernest P. Clark, New York. Application filed Feb. 16, 1891.

TELEPHONES AND TELEGRAPH.

463,188. Telephone. John W. Gibboney, Lynn, Mass. Application filed July 28, 1891.

463,207. Telephonic Relay. Ephraim E. Weaver, Philadelphia, Pa., assignor to Lewis O. Howell, Jr. Application filed Feb. 18, 1891.

463,340. Fire Alarm Telegraph Repeater. Geo. M. Stevens, Cambridge, Mass. Application filed April 30, 1891.

463,428. Telegraph Sounder. James Maret, Mount Vernon, Ky. Application filed Feb. 7, 1891.

463,544. Multiple Telephone Switch Board. Frank A. Pickernell, Newark, N. J. Application filed August 17, 1891.

463,545. Multiple Switch Board. Frank A. Pickernell, Newark, N. J. Application filed Aug. 17, 1891.

463,556. Speaking Tube Attachment for Telephones. Leando H. Snyder, Application filed Jan. 28, 1891.

463,569. Combined Telegraph and Telephone. Emile Berliner, Washington, D. C., assignor to the American Bell Telephone Company, Boston, Mass. Application filed June 4, 1877.

Claim 1. The method of producing in a circuit electrical undulations similar in form to sound-waves by causing the sound-waves to vary the pressure between electrodes in constant contact so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit, substantially as described.

2. An electric speaking-telephone transmitter operated by sound-waves and consisting of a plate sensitive to said sound-waves, electrodes in constant contact with each other and forming part of a circuit which includes a battery or other source of electric energy and adapted to increase and decrease the resistance of the electric circuit by the variation in pressure between them caused by the vibrational movement of said sensitive plate.

3. The combination, with the diaphragm and vibratory electrode, of a rigidly-held opposing electrode in constant contact with the vibratory electrode, substantially as described.

4. In a telephonic transmitter, a vibrational plate made concave for condensing the sound, substantially as set forth.

5. In a telephonic transmitter, a vibrational plate provided with one or more apertures, as and for the purposes set forth.

6. A speaking-telephone transmitter comprising a diaphragm or disk sensitive to sound-waves, combined with a rigidly-held but adjustable electrode in contact with the same, whereby the electric current is transformed into a series of undulations corresponding with the vibrations of said diaphragm.

ELECTRIC WELDING.

463,486. Process of Welding Metals by Electricity. Charles L. Coffin, Detroit, Mich. Application filed June 9, 1890.

463,487. Electric Welding or Working of Metals. Charles L. Coffin, Detroit, Mich. Application filed March 4, 1891.

CONDUCTORS, CONDUITS AND INSULATORS.

463,172. Insulator Support. Thomas C. Smith, Philadelphia, Pa.

463,420. Coupling for Electric Wire. Francis F. Gartland, Philadelphia, Pa. Application filed July 16, 1891.

463,512. Electrical Conductor. Philip H. Holmes, Gardiner, Me., assignor to the Fibre Graphite Manufacturing Company, Chicago, Ill. Application filed June 2, 1891.

463,587. Insulator Bracket. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew D. Ross. Application filed May 21, 1891.

463,588. Insulator Bracket. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew D. Ross. Application filed May 21, 1891.

463,605. Circuit and Switch for Electric Motors. Wilhelm Lahmeyer, Frankfort-on-the-Main, Germany, assignor to Lahmeyer and Co. Application filed March 26, 1891.

BATTERIES.

463,324. Galvanic Battery. Walter A. Crowdus, Memphis, Tenn. Application filed Nov. 21, 1890.

463,348. Galvanic Battery. Walter A. Crowdus, Memphis, Tenn. Application filed Jan. 24, 1891.

MISCELLANEOUS.

463,155. Electric Lock. Walter O. Johnson, Chicago, Ill. Application filed Feb. 25, 1891.

463,192. Electro-Magnetic Switch, Charles H. Herrick, Winchester, and Willis M. Rand, Boston, Mass. Application filed Oct. 20, 1890.

463,198. Electric Stop Mechanism. Lemuel Mellett, Somerville, Mass. Application filed March 21, 1890.

463,297. Electric Lock. Floyde H. Starrett, Clinton, Mich. Application filed Nov. 3, 1890.

463,298. Thermo Circuit Closer for Electric Fire Alarms. John Wrigley and Geo. P. Chambers, Paterson, N. J. Application filed June 26, 1891.

463,311. Electric Switch. Ernest J. Bagnall, St. Louis, Mo. Application filed Aug. 3, 1891.

463,384. Electric Cigar Lighting Apparatus. William W. Foster, Boston, Mass. Application filed Aug. 14, 1891.

463,395. Electric Train Signal. Joseph B. Strauss, Cincinnati, Ohio. Application filed July 20, 1891.

463,396. Electric Switch. Alfred Swan, Orange, N. J., assignor to the Insulite Manufacturing Company, New York. Application filed May 7, 1891.

463,558. Apparatus for Measuring and Recording Electric Currents. William Thomson, Glasgow, Scotland. Application filed Feb. 18, 1891.

463,570. Fire Alarm. Alphonse Bichet and Robert W. Whitney, Florence, Kansas. Application filed Feb. 19, 1891.

463,585. Electric Blower or Fan. Walter B. Snow, Watertown, Mass., assignor to the B. F. Sturtevant Company, Boston, Mass. Application filed April 7, 1891.

463,586. Mast Arm for Electric Lights. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew B. Ross. Application filed Oct. 6, 1890.

463,608. Automatic Fire Alarm System. Gilman W. Brown, West Newbury, Mass., assignor of one-half to Hayden Brown. Application filed Aug. 21.

ELECTRICITY.

VOL. I. CHICAGO. DECEMBER 9, 1891. NEW YORK. No. 21.

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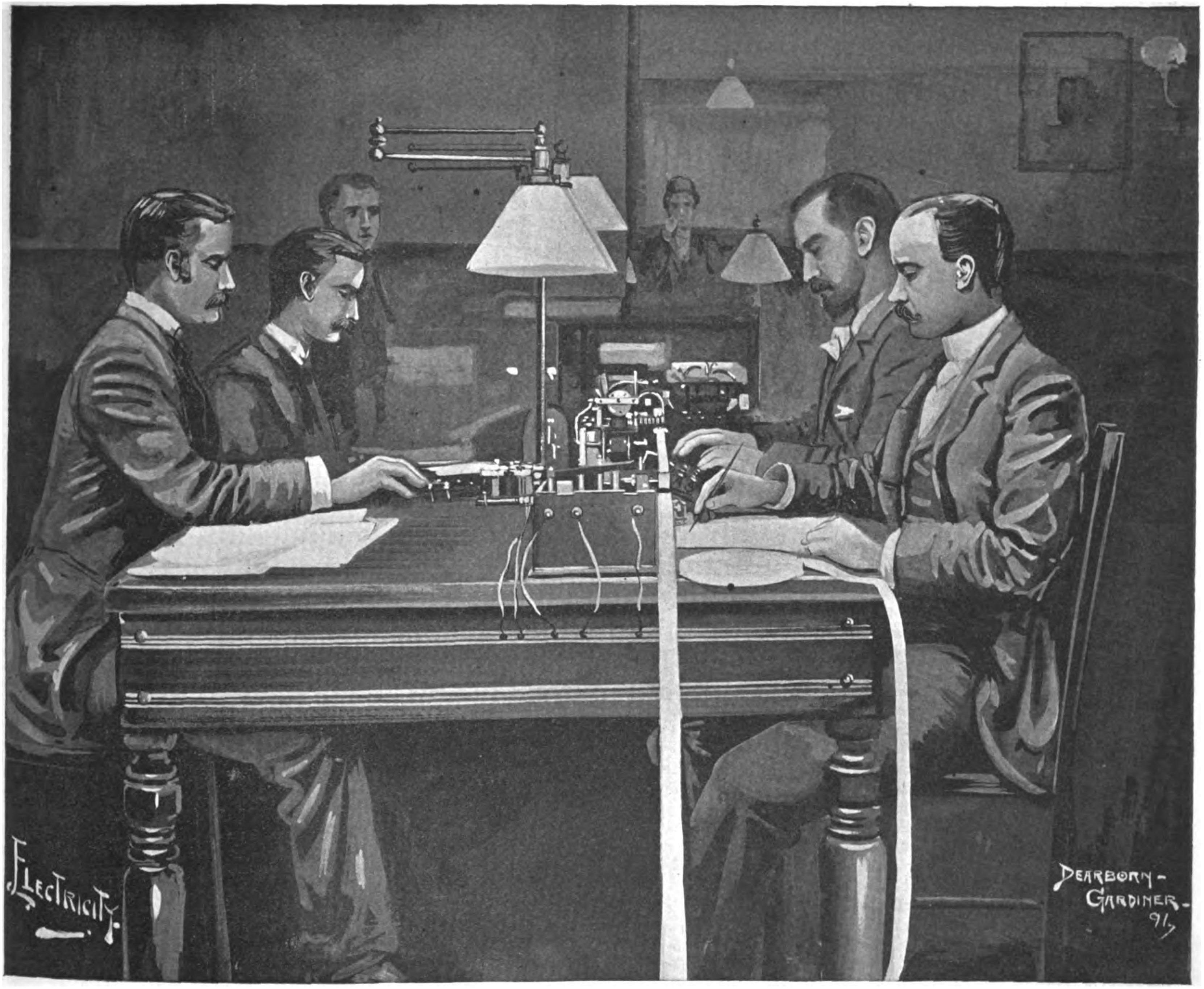


OPERATING ROOM OF THE COMMERCIAL CABLE COMPANY—USE OF THE TYPEWRITER IN SUBMARINE TELEGRAPHY.

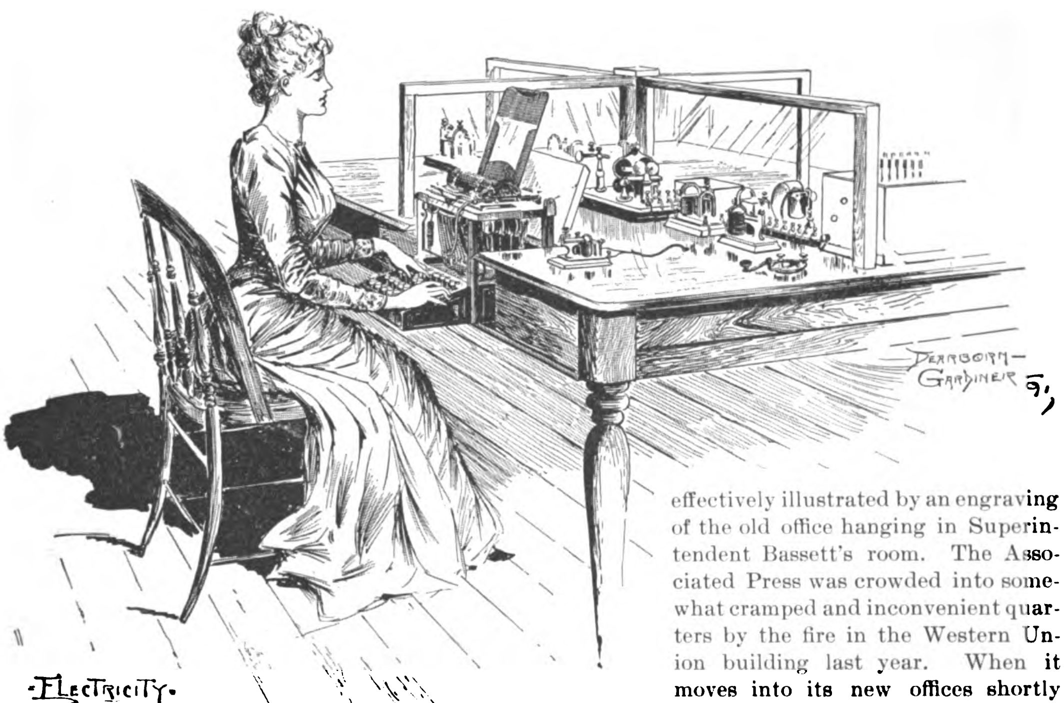
(*See page 266.*)

THE TYPEWRITER: FIRST LIEUTENANT TO THE TELEGRAPH.*

BY S. J. PRYOR.

By far the most important and valuable improvement in the efficiency of the electric telegraph in the past three or four years has been brought about by the introduction into telegraph work of a machine that has absolutely nothing electrical about it. While not all inventions that give added efficiency and greater advantages to the community contribute increased comfort to those required to use them, some rather entailing more laborious work or more fatiguing and trying conditions to the individual, the use of this invention has rendered easy and pleasant a class of work that was tiring and nerve-wearing in the extreme. The thing that has done all is the typewriter. This marvellous little labor-saver and life-lengthener has become absolutely indispensable in several of the more important branches of the telegraph service, a necessity to the complement of every first class operator, and soon its lively patter will be the unvarying accompaniment to the brisk clicking of the sounder in every telegraph office in the land.

"There has been a revolution in telegraphy," said Superintendent Bassett, of the United Press, a few days ago, "and it is the typewriter, backed



Telegraph Table with Typewriter in Position.

by its ally the Phillips code, that has accomplished it." The general results of this revolution are that the capacity of the telegraph service has been doubled and its accuracy very largely increased. The use of the typewriter in telegraph work has doubled the value of every live newspaper in the country by enabling it to print twice as much news, and better, because later, news. This means so much added pleasure and profit to every intelligent citizen, for every intelligent man reads the newspapers. It has immeasurably increased the accuracy of the whole service by giving legible copy to both the transmitter and receiver of telegrams, and has increased the sum of the nation's piety for the same reason, for many operators, almost the majority, write most exasperating hands; styles which would suggest, if there is anything in graphology, that the disposition and character of the average operator must be a fearful and wonderful thing. It has also further increased the speed of transmission for the same reason of legibility, by avoiding irritating repetitions and delays and in many little technical details. It has increased the profits of the companies by increasing the capacity of their plant, and it has increased the earnings of the operators by enabling them to do more and better work, a fact which the companies are recognizing on their pay rolls.

The most striking example of the value of the typewriter in telegraphy is afforded by the press service. In this branch it has entirely superseded the pen and stylus throughout the whole country, and no operator is eligible for a position on a United Press or Associated Press circuit, or practically on any press wire, unless he is a typewriter expert. He simply could not do the work. And what follows in regard to this department may be taken as applying, in a general way, to the whole system of telegraphy.

The typewriter was first introduced into the office of the Associated Press as an experiment about seven years ago, and for the last two years it has been used exclusively in all offices of the United Press and the Associated Press. When the United Press was preparing its new quarters in the "World" Building in New York an entirely new style of telegraph office was constructed. Everything in the fittings of the office and arrangement of the instruments was made to conform to the new order of things, and the appearance of the office now, in every detail, is altogether unlike the telegraph office of the old days, a fact very effectively illustrated by an engraving of the old office hanging in Superintendent Bassett's room. The Associated Press was crowded into somewhat cramped and inconvenient quarters by the fire in the Western Union building last year. When it moves into its new offices shortly there will be another surprise for the old-timers, and if any one of these old flyers should want to go back to the key he would have to learn the business all over again.

The United Press has six circuits running out of New York, reaching all the principal points as far west as St. Paul, and south to New Orleans. The number of offices on a circuit varies from eight to twenty. The Associated Press serves practically the same points by substantially similar circuits. Over these wires the special despatches from the various points are received, and the main volume of news collected in New York, the great collecting and distributing point, is sent out for service to the newspapers in the associations. This is called the "report."

Before the introduction of the typewriter the "night report" averaged about eight thousand words on each wire, and the whole day's work amounted to about eighteen thousand words. Now the night report runs to about fourteen thousand words, and the whole day's service averages about thirty thousand words. The reading public gets just that much more news.

A first class operator can send about forty words a minute, continuously and well, but experience has shown that it is very difficult for a man to write with a pen or stylus more than thirty or thirty-five words a minute, steadily and continuously, for a number of hours. The service of the press associations in New York requires from twenty to thirty copies to be taken of every dispatch. In other cities the number varies from four or five copies upward. These were formerly made with an iron or agate stylus on tissue paper interleaved with carbonated sheets. The labor of pressing through so many thicknesses of paper in order to make a legible copy on each is enormous. The strain, muscular and mental, of writing thirty-five words a minute in this manner, for eight or nine hours nightly, following the dictation of a sender who could always greatly excel the writer in speed, has been responsible for the nervous and physical breakdown of hundreds of operators. Telegraphers who have "lost their grip," either through writers' paralysis, contracted in this way, or through general breakdown, who from being strictly first class operators have dropped to third rate, are common all over the country. Every office knows them.

On the typewriter a speed of seventy words a minute is easily acquired and maintained, and with slight modifications in the machine thirty copies, and more, can be taken with as much ease as one. There is no cramp and little fatigue in the operation of the typewriter, for eight fingers do what was the work of two, or practically eight motions take the place of one. But the advantages of the typewriter in its simple capacity need no elaboration here. Its introduction has made first class operators of those who were of second rate grade, and has abolished the dreaded "dead line" which a man crossed into uselessness when he "lost his grip."

Losing his grip meant to the operator losing his position and his ability to earn a living in his regular business. The typewriter has not only abolished that much-dreaded possibility, but has in many cases opened a more lucrative field to such men. A recent case in the Canso, N. S., office of the Commercial Cable Company will illustrate. One of the best operators in the office came to the chief in great distress and said his hand had "gone back on him" and he absolutely could not work. He saw nothing to do but endeavor to learn some other business. The company provided a typewriter for him, the man learned its use, and is now a much better operator and a more valuable man than he was at his best with the pen. The Commercial Company provides machines for its operators to learn on and to use.

With the introduction of the typewriter the sending operator dropped away in the rear, and from being an autocrat, oftentimes a cruel one, he has fallen to the place of a lagging, impotent clown. Then the practice of abbreviating came into use, and the sender in his effort to keep up to the machine clipped his words and dropped out their vowels. Mr. Walter P. Phillips, General Manager of the United Press, has devised and compiled a code of abbreviations and logograms, skilfully aranged with a view to the best utilization of the shortest and most convenient signals in the telegraphic alphabet. It is a very excellent system of telegraphic shorthand, and is now in general use for press work all over the country. A few excerpts from the code will show its character and scope and give an idea of what may be accomplished in the way of speed with its aid.

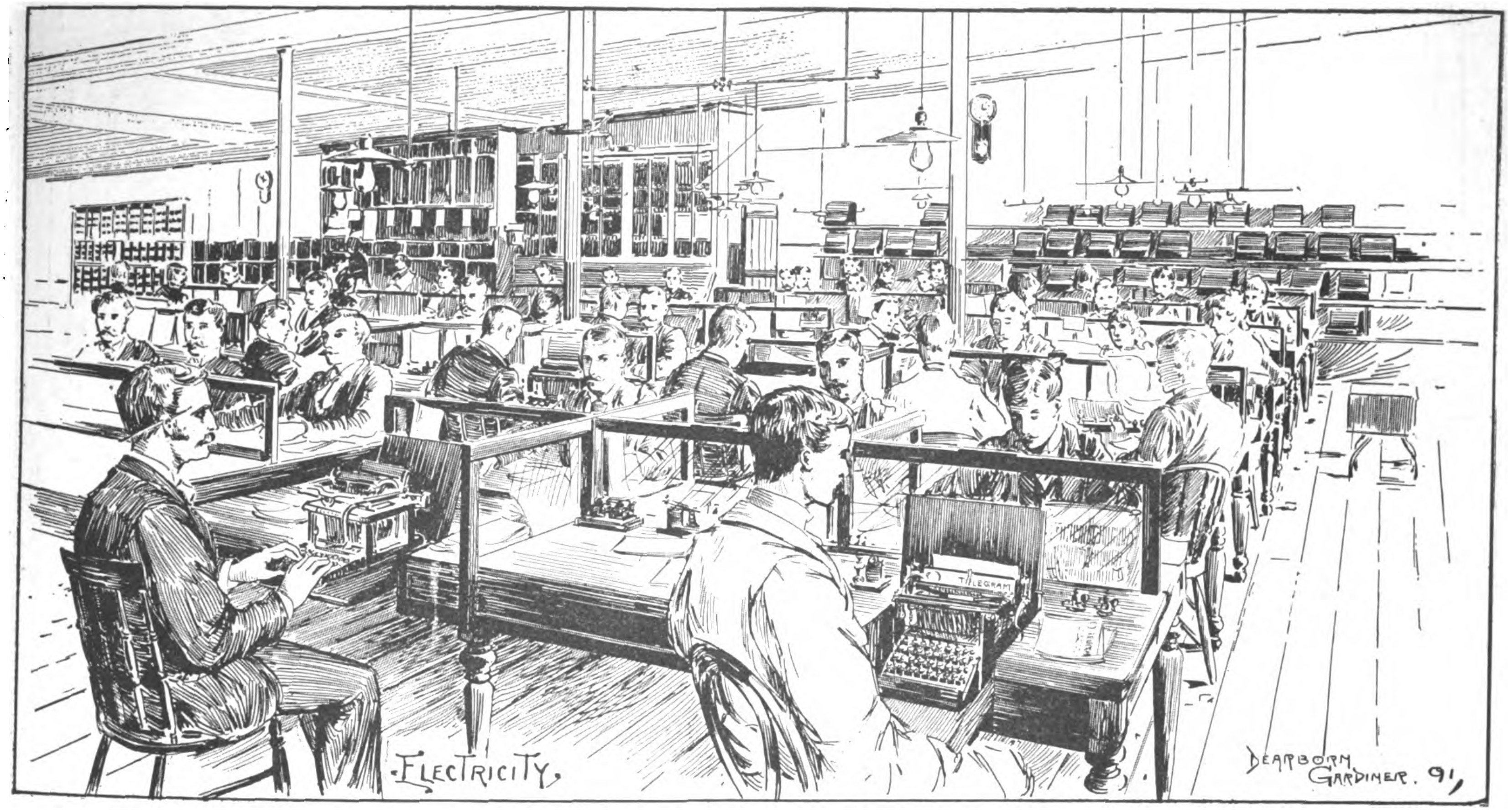
Short phrases that occur frequently are represented by single letters, as; "F" means "Of the;" "K" means "Out of the;" "V" means "Of which," and so on. There are about six thousand abbreviations and symbols of two and three letters representing much used words, or short phrases. "Pprn" stands for "preparation;" "Sby," "subsequently;" "Nbh," "neighborhood;" "Kcn," "concentration." There are some especially brief contractions, as; "Oljod," meaning "Only a limited jobbing demand;" "Mwdc," "Market without

decided change." This aggregation of letters "If ou blgs can n alw hv t supm adg o rpsntg trad, ty r at leas dilgnt in thr dvon to uglines," coming over a wire would be written out by the type-writing operator "If our buildings cannot always have the supreme advantage of representing trade, they are at least diligent in their devotion to ugliness."

With the aid of the Phillips code the sending operator can transmit sixty words a minute with greater ease than he could send thirty without it. The receiving operator with his typewriter can keep up to this speed as a pleasant pastime. It is impossible to rush him. The actual speed of transmission has been increased from between thirty and thirty-five words to from fifty to sixty words a minute. On one occasion recently the United Press sent an important news special of 3,500 words, to all the newspapers taking its service, in fifty-five minutes. Consequently the newspapers get about twice as much telegraphic news as they did before the use of the typewriter became general. They get longer reports of important news, a greater variety of news, and much later news, because the telegraph can handle as much matter in the closing half hour now as it correspondence the same field for quickening the service by the use of abbreviations as in press work, the typewriter enables the receiving operator to copy messages at the top speed of the sender, a very considerable gain over the pen. It provides a better copy in every way, and to a great extent prevents vexatious repetitions and resulting delays—an important consideration on a duplex or quadruplex circuit. It is especially a relief to the operator, who can do quicker and better work, and for a much longer period, without the nervous strain and hard work that formerly oppressed him. For these reasons and a dozen more little ones, apparent in the practical work of a large telegraph office, the use of the typewriter has largely increased the capacity of every wire and the value of the whole telegraphic service.

The Postal Telegraph Company has used the typewriter in its offices on the Pacific coast for some little time, and last February the machines were introduced into its New York office, at 187 Broadway. The company rather induced than forced its introduction, and the machine has taken its place solely on its merits with the operators. There are now about a hundred in use in this office. They are used by about one-third of the entire force of operators, and the proportion is increasing steadily. The company announced that it would be glad to have the operators learn to use the typewriter, and added that an increase in pay of one dollar a week would be given to every operator using the typewriter in his work. The operators readily appreciated the many advantages of the machine, with the result told above. The operators own their machines individually, and all makes are in use, but the Remington is the favorite. The illustration on this page has been reproduced from a photograph of the Postal Company's New York office, taken during business hours, and shows the typewriters in position and the operators at work in their regular routine. The typewriter is also in use in the branch offices of the company throughout the city, almost to the exclusion of the pen. The Western Union is not doing much with the typewriter in commercial work in New York at present, except in the Wheatstone department, where the messages are copied from the printed Morse slip. This is mainly owing to the general upset and the present chaotic condition of the operating department, caused by the fire which partly destroyed the building last year. When the company moves into its new operating rooms and its arrangements are straightened out, the typewriter will be a very prominent feature in the economy of the New York office.

A perplexing problem was presented in the New York office of the Postal Telegraph Company by the difficulty of suitably placing the typewriters in connection with the telegraph instruments for general work. This problem, which had arisen elsewhere, was solved there for the country at large. The regular typewriter stands could not be used, although they are in the smaller offices, for lack of room and on account of the great number of wires, and because inconvenient to the instruments. The adoption of drop cabinets would involve great expense in the entire refitting of the office, and their bulk would have required a larger office. The desks had to be available for use by either typewriter operators or penmen, and simply placed on the desk the typewriter was too high, and out of reach. After much experimenting, Superintendent E. G. Cochrane, of the New York office of the Postal Company, with the help of suggestions from the chief operator, Mr. Charles Shirley, devised the plan shown in the illustration on the opposite page, which shows the details of the arrangement of typewriter and telegraph instruments. The sounder can be moved about at will to any part of the desk most convenient to the receiver. The loose top of the desk is in the form either of a slide or a hinged lid. This arrangement has been generally adopted as the most compact and convenient adaptation of the desks now in use in all telegraph offices.



OPERATING ROOM OF THE POSTAL TELEGRAPH CABLE COMPANY, NEW YORK.

used to in an hour before. The same conditions of cause and effect apply in a more or less extended degree to the private service of every newspaper in the land. All the important newspapers in New York, Chicago, Boston, and in very many of the smaller cities, have from two to six or eight special wires running into their offices, over which they receive the special despatches from their own correspondents all over the country. And the typewriter has multiplied the usefulness of these wires in the same degree that it has those of the press associations.

In the much wider field of commercial telegraphy, which covers the telegraph in all its other uses and applications, except railway signalling, the use of the typewriter has become almost as extended, and for practically the same reasons. It has even entered into the economy of the submarine telegraph system, a branch of telegraphy which is hedged in by peculiarities that make the introduction of novelties very difficult. While there is not in business and social telegraphic

The desks in the New York office of the United Press were especially designed and are in admirable accord with the general style of the office, which is considered to be the most handsomely fitted, complete and most conveniently arranged telegraph office in the country. The illustration of the office, page 267, reproduced from a photo-

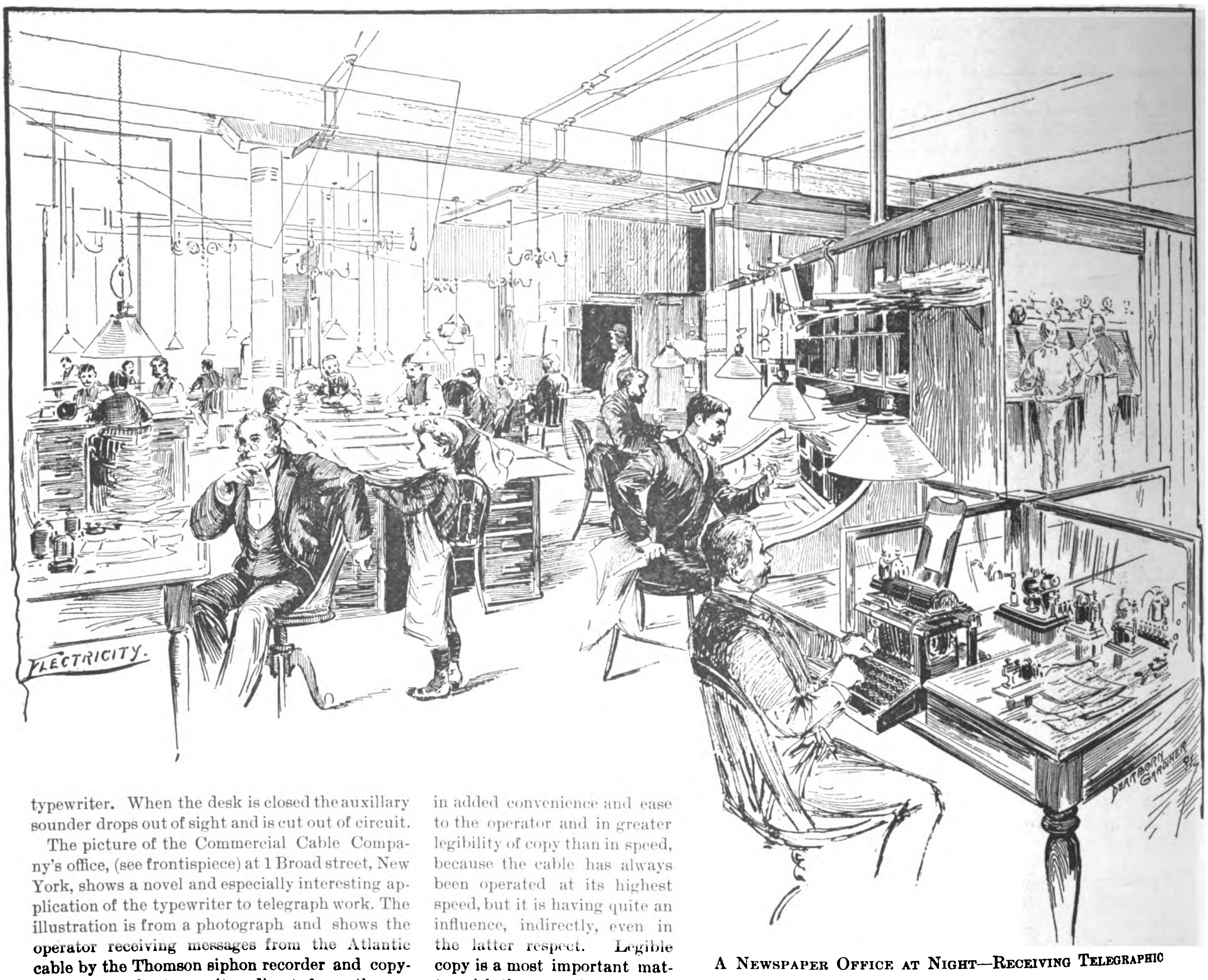
graph taken for Electricity, shows one corner of the operating room with the desks and instruments of four of the heavy press circuits. The desks are open and the typewriters in position for receiving, and the whole working arrangements are shown just as the operators stepped aside from their work in order to afford a clear view of the apparatus for the purposes of the picture. The desks are of the drop cabinet style and when it is necessary to use a wire for sending the lid of the desk is shut down, the typewriter drops out of sight, and there is a clear desk for the sending operator. The regular sounder is seen at the right with the other instruments; an extra sounder is fixed on the moving table, to the left of the typewriter, so as to better enable the operator to hear the signals above the clicking of the typewriter. When the desk is closed the auxillary sounder drops out of sight and is cut out of circuit.

The picture of the Commercial Cable Company's office, (see frontispiece) at 1 Broad street, New York, shows a novel and especially interesting application of the typewriter to telegraph work. The illustration is from a photograph and shows the operator receiving messages from the Atlantic cable by the Thomson siphon recorder and copying them on the typewriter direct from the recorder slip. This is a decided innovation in submarine cable telegraphy, and is as yet a novelty confined to this particular office. The Commercial Company, with its characteristic and customary enterprise in endeavoring to utilize everything promising an improvement in the cable service, began experimenting with the typewriter some six months ago. After considerable trouble and persevering effort, the peculiar difficulties and the prejudices presented in this branch of telegraphy have been overcome and the typewriter is established as a permanent feature of the company's cable service. Such extreme nicety of skill and judgment is required in receiving messages by the siphon recorder that during busy times two men were usually detailed to handle the work, one calling off the signals and the other writing them down, or each man copying alternate messages from the slip. With the typewriter one man is easily able to do the work, and with much greater comfort and less strain. The slip passes from the recorder, on the right, and is drawn by the motor, shown to the left of the operator, across the front of the typewriter, just above the top row of letter-keys. It is kept in place by two small guides, and the operator has the "signals" immediately over the keys of his typewriter. He does not have to keep glancing from the slip to his writing, because he is sure that it will be perfectly even and legible, so he can use his eyes solely in deciphering the puzzling hieroglyphics on the swiftly moving slip—work enough for one pair of eyes.

The advantages of the typewriter here are more in added convenience and ease to the operator and in greater legibility of copy than in speed, because the cable has always been operated at its highest speed, but it is having quite an influence, indirectly, even in the latter respect. Legible copy is a most important matter with the complicated ciphers used in international telegraphy, and while cable operators almost invariably write a good, plain style, very serious and expensive errors have at times resulted from indistinct letters. The advantages of print over handwriting, then, are obvious. The Commercial Company also uses the typewriter on its Morse cable wire, from Cape Canso, as shown in the illustration, and with the same success as mentioned in connection with the Postal and Western Union services. It is used at Cape Canso, N. S., the landing place of the main cables, and also at the other stations of the company, and the operators and chiefs speak very highly of its general utility. The typewriter is also used on the Morse wires of some other cable companies, but not in connection with the siphon recorder.

Some alterations and improvements have been made in the typewriter in adapting it to telegraph use, and all have been made by operators, guided by practical experience. For press work, where a great many copies of each despatch are required, a cylinder made of brass or wrought iron has been substituted for the rubber roller. This gives a hard, unyielding surface for the type to strike against, and the last copy of thirty-five is as plain as the first. The paper used for press despatches is very thin and is cut in sheets about twelve or fourteen inches long. In order to keep this even and level a feed guide, made of japanned tin, is used. A larger style of type is used than in the ordinary machines, and some additional symbols are introduced. The typewriters used by the Commercial Cable Company are fitted with figures of various sizes and by an ingenious scheme every possible fraction can be compactly expressed.

The telegraph companies do not require the use of any particular make of typewriter, but the Remington and the Caligraph have been found to be best adapted for telegraph work, and but few machines of other makes are used. The Caligraph is extensively used and with good satisfaction, but the Remington seems to have the preference with operators and is well in the lead. This preference is because of the Remington's solidity of construction, its capacity for continuous hard work and its non-liability to get out of order at critical times. It answers all the exacting requirements of telegraph work, is compact, and, as operators say, "It stands the racket." The As-

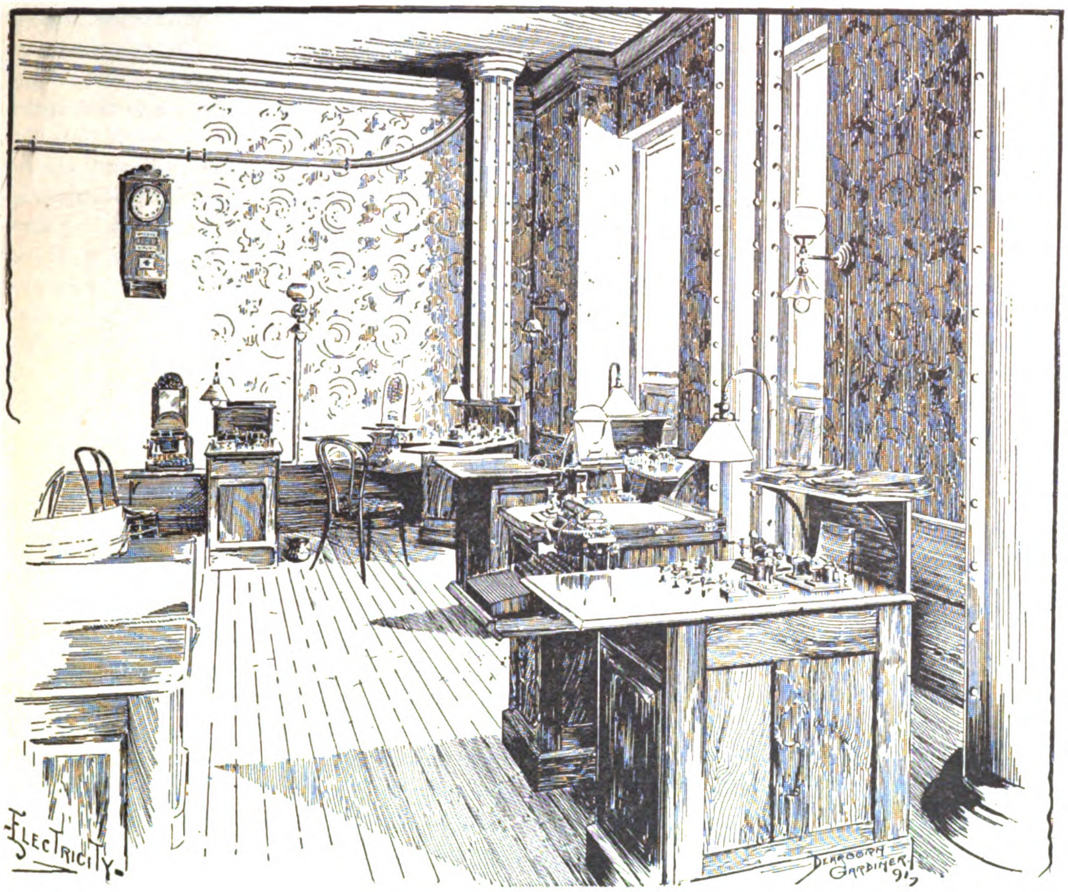


A Newspaper Office at Night—Receiving Telegraphic Despatches on the Typewriter.

sociated Press has abandoned all other machines in favor of the Remington.

But a consideration of the respective merits of different typewriters in telegraph work, or of the particular advantages possessed by any one machine, is immaterial here. The interesting point is the fact of the complete transformation effected in the practical utility of a peculiar scientific industry by the adoption of an invention altogether distinct in every particular from any application of that particular science, and the consequent wonderful broadening out of the usefulness of a great public service.

The offices described or referred to in this article and the examples given are merely convenient instances. What is true of New York's telegraph service is true, in a greater or lesser degree, of every telegraph office in the country, large or small. The click of the typewriter accompanies the click of the sounder in every corner of the land, and it is only a matter of a very short time when its use in telegraphy will be universal.



A CORNER IN THE NEW YORK OFFICE OF THE UNITED PRESS.

THE CENTRAL ELECTRIC LIGHT COMPANY'S PLANT BURNED.

By a peculiar combination of circumstances a large number of Chicago merchants were compelled to return to gas for lighting their buildings during a few days. As reported in ELECTRICITY last week, the entire plant of the Chicago Arc Light and Power Company's station was destroyed by fire. The following night a fire in the Adams Express Company's building destroyed the Central Electric Light Company's station. The plant consisted of four Fort Wayne Jenney Incandescent dynamos of an aggregate capacity of 5,000 lights and a 500 h. p. Hamilton Corliss engine. The fire originated in the boiler room directly over the boiler, and in no way can it be traced to a short circuit or to any cause implicating electricity. The loss on the engine and dynamos is estimated at about $30,000, partially insured. By an arrangement with the Sun Electric Light Company, the Central Company have been enabled to serve most of their customers with very little delay.

SOME LETTERS ON LIGHTNING PHOTOGRAPHY FROM PROFESSOR TYNDALL.

Of the numerous original articles published in ELECTRICITY, scarcely any one has attracted more widespread interest than that entitled "Jove's Autograph: How He was Induced to Write it on the Photographic Plate" by Mr. W. N. Jennings, which appeared in our issue for September 30th. The beautiful photographs of lightning flashes which we reproduced from Mr. Jennings collection appealed both to the photographer and to the electrician as remarkably fine specimens of a very difficult class of work.

Mr. Jennings has for many years maintained a correspondence with Prof. Tyndall, the eminent English physicist, on this subject of lightning photography and he has kindly furnished us, for publication, some of Prof. Tyndall's letters, which we print below. They show a hearty appreciation of Mr. Jennings' skill as a photographer of nature's electrical displays.

ROYAL INSTITUTION OF GREAT BRITAIN,
19th Oct. 1885.

Dear Sir,

I am very sincerely obliged to you for the photograph of the lightning flash which you have been good enough to send me.

There is no mistaking the identity of the flash with the long electric sparks.*

Yours Faithfully,
JOHN TYNDALL.

HIND HEAD HOUSE, HASLEMERE,
March 21, 1888.

Dear Sir,

On the 28th of June, 1887, you addressed to me a letter, and enclosed to me a photograph of a streak of lightning.

1887 was a year of suffering for me, from which, happily, I have victoriously emerged; and fearing that I may not have written to thank you when your communication reached me, I beg to do so now.

Anything so exquisitely sharp as your photograph, I have not hitherto seen. It strikingly illustrates the marvellous perfection which the art of the photographer has reached.

Yours very faithfully
JOHN TYNDALL.

*The photograph referred to in this letter is the first picture on p. 144, ELECTRICITY, Sept. 30. ED.

HIND HEAD HOUSE, HASLEMERE,
July 18, 1888.

My Dear Sir,

I owe you, and offer you, my very best thanks for the exquisite photograph of a lightning flash which you have been good enough to send me. Nothing so beautiful as your successes in this line ever came under my observation.

Very faithfully yours,
JOHN TYNDALL.

HIND HEAD HOUSE, HASLEMERE,
July 7, 1890.

Dear Sir,

Allow me once more to thank you for the exquisite photographs of lightning. They are in the highest degree instructive. We are packing up for the Alps, whither we proceed on Monday next. My address will be, Alp Lusgen, Brieg, Switzerland, until October, when we return here. Excuse this brief reply. It would be longer were it not for the pressure of my preparations.

Faithfully yours,
JOHN TYNDALL.

ALP LUSGEN, BRIEG, SWITZERLAND,
12th September, 1890.

My Dear Sir,

Your last exquisite lightning photograph reached my hands to-day, having been brought to me from England by Mrs. Tyndall. I know nothing of the kind more beautiful or more instructive than these photographs. The multitudinous streaks resembling discharges put me in mind of the ceaseless thrilling of lightning over the Italian mountains, which we not infrequently observe from our position here. I am truly obliged to you for sending me these illustrations of your skill.

Yours faithfully,
JOHN TYNDALL.

AN AMBITIOUS ELECTRIC RAILWAY PROJECT.

Of the proposed electric railway between Buda-Pesth and Vienna, further details are given in a late number of the *Verkehrs Zeitung*. According to these, there will be for the 149 miles of road, two main power stations with 100 substations, and only three or four stopping places. The cars will be 131 feet long, and will be fitted with four two-axle bogie trucks. At each end of a car there will be two large electric motors, to which the current will be transmitted by contact wheels running on conductor rails. The speed which it is proposed to attain in regular working is 200 kilometres (124.2 miles) per hour, and in order to diminish the air resistance the ends of the cars will be shaped like ships' bows. The distance between Vienna and Buda-Pesth is to be covered in 75 minutes, and cars are to be run at quarter-hour intervals. Up to the present, permission to build the road has not been granted by the authorities, but there is thought to be little doubt that the line will be taken in hand in the near future.

According to some calculations recently made, the gross and available water power in Switzerland are shown in the following table:

	Gross H. P.	Available H. P.
Rhine District	2,907,695	435,080
Rhone "	917,294	116,114
Po "	342,496	37,889
Danube "	277,192	30,898
Etsch "	1,570	126
Total	4.446,247	620,107

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The Typewriter in Telegraphy. The elaborate article by Mr. S. J. Pryor, on the use of the typewriter in the telegraph service, which we publish in this issue, will be read with interest by telegraph engineers and managers the world over. Mr. Pryor has described the benefits which have resulted from the co-operation of the writing machine with the telegraph with such detail that there is little left to add by way of comment. Greatly increased speed of working, perfect legibility and compactness of copy are sufficient inducements to any telegraph manager to include a typewriter with every set of instrument he installs. Reference is made in the article to the adoption of the typewriter by one of the Atlantic cable companies. In submarine telegraphy there is evidently a great field for the typewriter. Telegrams sent long distances by submarine cable have to be re-transmitted a number of times. Although every care is taken in checking the messages, this frequent handling naturally introduces a chance for error; with typewritten messages the possibility of error through mistaken reading of handwriting would be wholly removed. In some cases messages are handed by the cable stations to foreign operators, and here again typewritten messages would do away with a great many of the errors that often occur in telegrams which have to pass over foreign government lines. Where several copies of each message are required the typewriter has manifest advantages; carbon copies to almost any number are easily made, and no copying machine is required. To return for a moment to the matter of speed, it is quite evident that a receiving operator who is fairly proficient in the use of the typewriter can keep up without an effort with the fastest sender on any style of instrument, producing perfectly clean and legible copy. It is curious to watch the reception of messages in this way; with the sounder working at top speed the operator with his typewriter seems to be taking things quite leisurely.

* * *

The Electric Girl Abroad. Under the waggish title of "The Magnetic (*sic*) Lady," Mr. J. B. Verity contributes an amusing letter to the London electrical papers, relating his experiences at a performance of the electric girl now exhibiting her powers before British audiences. Perhaps we are not showing due respect to this particular phenomenon in referring to her as an electric girl, because she is a married woman (who presumably ought to know better) and prefers to be known as "the magnetic lady," but we are quite sure that she cannot have appreciated Mr. Verity's description of her as "the magnetic (*sic*) lady;" indeed, judging from his description of her performance, she seems to be a particularly well lady. Mr. Verity claims to have felt, when he placed his hand in contact with that of the magnetic lady, a "vibratory agitation" similar to what he has on certain occasions experienced when near a powerful dynamo. As Mr. Verity states that he is "by no means a stranger to the Alhambra stage," it may possibly be that he has there experienced "a vibratory agitation" on other occasions certainly not due to any electrical influence, and we are not inclined to attach very great importance to a feeling so vague as a vibratory agitation; such an effect may be produced in many different ways. The editor of the *Electrician*, in commenting on Mr. Verity's letter, is distinctly sceptical, and very pertinently urges that mechanical tests would be more likely to clear up the mystery than any other method of investigation. When last week's issue of ELECTRICITY reaches London, however, the whole thing will be, in American parlance, "given away."

* * *

Electricity and Science. Prof. Wm. Crookes' remarks on "Electricity in Relation to Science," an abstract of which we give elsewhere, afford much food for reflection. The idea that electricity is molecular is at first somewhat startling, although it is a view that has gained some ground of late in certain quarters, but still more startling is the statement that in a cubic foot of ether there is locked up 10,000 foot tons of energy. Prof. Crookes does not state this on his own authority, nor does he imply in any way in what form this energy is stored. Many of our leading scientists believe that the ether has mass, and some of them have gone so far as to calculate just what that mass is. While the results of these calculations vary between extremely wide limits, they all agree in assigning to it a density so extremely small as to be mentally inconceivable. We cannot conceive of energy disassociated from mass, and in the case of the ether, the mass being so small, it is inconceivable that there should be any large amount of energy stored or locked up in a given space. Then too, whence comes or came this force which, acting upon the mass, gives or gave that energy which Prof. Crookes thinks will one day be on tap for us? The ether we know to be capable of transmitting enormous amounts of energy at the rate of about 186,000 miles per second, but that it is capable of rendering that energy latent in large quantities is not one of the properties that have usually been ascribed to the ether in its free or unbound state, nor is it one that can be legitimately ascribed to it without doing violence to all of the more prominent hypotheses as to the construction and nature of the ether. In the fact that walls and fogs are impervious to light rays while they form no barrier to electric waves of a foot or two in length we have a suggestion of the possibility of transmitting signals at sea or elsewhere through walls or fogs by means of electrical waves to which they are perfectly transparent. These waves might be made visible at the receiving end by converting them again into visible light waves. The possibilities in this direction are very apparent, and the actual accomplishment only awaits a method of transformation from the longer to the shorter wave length.

* * *

The Electric Locomotive. The new electric locomotive just completed for the Whitin Machine Co. by the Thomson-Houston Co. is an object of more than usual interest in electrical circles and is likely to mark the beginning of an era in electrical application not second in importance to that of the electric motor to street car propulsion. Notwithstanding that so much has been said and written on the efficiency and economy of the electric motor in street car and other work, the leading manufacturers have heretofore been very chary of the guaranties they would make for that larger application to freight and passenger traffic on what are now steam railways. The practical application of electricity to commercial uses of all kinds has been so rapid that if it seems to lag behind for a year or two in any particular direction we are apt to feel impatient and call it slow. But it is a fact that manufacturers have hitherto held back from enterprises such as the one described in another column. Within the last two years we personally know of two specifications of this kind being declined by one of the leading concerns engaged in equipping electric railways. One was to equip a standard gauge road some three miles in length with an electric locomotive capable of hauling three passenger or two freight cars over a maximum grade of four and one-half per cent. The other was for a like equipment for a narrow gauge of the same length but lesser grades. The work in both cases was at the time being done by steam locomotives and there were many incentives to the company to bid on the proposed plans. Their decision was that they would equip the roads only at the risk of the purchasers. By thus declining, they not only missed the opportunity of being the first in the field in this class of work but probably lost much business that would surely have followed. We congratulate the Thomson-Houston Co. upon the position they have assumed and the enterprise displayed, and predict that now the ice is broken a rapid development will follow.

* * *

Actinism and Electrolysis. Prof. Edwin J. Houston, in a very suggestive paper read before the Franklin Institute last month, with the title, "Is Actinism a Species of Electrolysis?" discusses the possible identity of actinism in the growing leaf, when exposed to the sunlight, and electrolytic decomposition. After stating that it is now pretty generally recognized that a difference of potential does exist in the various parts of a growing plant, he enumerates the principal causes, both resident in the plant itself and external to it, to which these differences of potential are probably due. Among the former, he mentions the evaporation of liquid substances given off from the body of the plant. The ques-

tion whether evaporation *per se* results in a difference of potential or not is one that has received great attention at the hands of scientists, with the result that the weight of the evidence goes to prove that it does not. In regard to the external causes Prof. Houston mentions as chief among them the difference of illumination on the two sides of the leaf or stalk. He suggests that careful experiments be instituted to ascertain whether there exists on the opposite faces of a growing leaf, when exposed to the full action of sunshine, a difference of electrical potential resulting from the polarization which always accompanies electrolytic decomposition, and if so, what is the nature of such polarization. "If such differences of potential actually exist," he says, "it would of course follow that the illuminated face of such leaves, under polarization, would be mainly electro-negative, since it is at or near this face that the carbon and less highly oxidized carbon compounds appear, while the dark or less illuminated face would be electro-positive, since it is here, for the greater part, that the oxygen is liberated." It appears to us that this is a *non sequitur*, for if the luminous or actinic rays are the seat of energy, and the carbonic acid, for instance, is the electrolyte (as is suggested by the fact that it is that which is electrolized instead of the juices of the plant), the leaf becomes merely a conductor, and the illuminated side would then be the positive and the non-illuminated side the negative, instead of the reverse, as Prof. Houston suggests. However, the experiments suggested would be exceedingly interesting and could not fail to produce valuable results if properly carried out. As a means to this end Prof. Houston proposes the construction of a "leaf battery" by connecting "the illuminated face of one leaf with the non-illuminated face of another, and so on in series until any feeble differences of electrical potential that there might exist are sufficiently multiplied to sensibly affect the needle of a galvanometer." Such a means would, we think, be entirely useless for the purpose, inasmuch as where the electromotive forces are so slight and the resistances so great as they probably are in the case in question, no material advantage could be expected from a leaf battery connected up in series. Prof. Houston, however, merely hints at a line of investigation, hoping to attract due attention to it. We agree with him perfectly in the importance of the subject, and our object has been, not to be critical, but to assist in the accomplishment of further research by incidentally showing where we think he is mistaken in the interpretation of the phenomena and the proper means of elucidating them.

ELECTRICITY IN RELATION TO SCIENCE.

Prof. Wm. Crookes, in response to the toast "Electricity in Relation to Science," given at the third annual dinner of the Institution of Electrical Engineers, said "Substantialists tell us that electricity is a kind of matter. Others view it not as matter but as a form of energy. Still others reject both views. Dr. Lodge considers it a form or rather a mode of manifestation of the ether. Nikola Tesla thinks 'nothing stands in the way of our calling electricity ether associated with matter, or bound ether'

"The light which the study of electricity throws upon a variety of chemical phenomena can not be overlooked. The old electro-chemical theory of Berzelius is superseded and a new and wider theory is opening out. The facts of electrolysis are by no means either completely detected or co-ordinated. They point, however, to the great probability that electricity is atomic—that an electrical atom is as definite a quantity as a chemical atom. The electrical attraction between two chemical atoms being a trillion times greater than gravitational attraction is probably the force with which chemistry is most deeply concerned.

"It has been computed that in a single cubic foot of the ether which fills all space, there are locked up 10,000 foot tons of energy which have hitherto escaped notice. To unlock this boundless store and subdue it to the service of man is a task which awaits the electrician of the future."

In speaking of electrical oscillations Prof. Crookes said that with every diminution in the size of apparatus the wave length became shorter, and that if we could construct Leyden jars of molecular dimensions, the rays might fall within the narrow limits of visibility. He noted that while light rays would not pass through a wall or a dense fog, both walls and fogs are entirely transparent to electric waves a foot or two long.

A GENERAL REVIEW OF THE WORK OF THE DEPARTMENT OF ELECTRICITY OF THE WORLD'S COLUMBIAN EXHIBITION.

From an almost inconsiderable part of the Columbian Exposition, the Department of Electricity has grown to be at least as important as the other great sections, and the public have come to anticipate an exhibit that will rival in interest, instructiveness, and spectacular beauty any public exhibition that has ever been held. The Electrical Department is the pride of the exposition management, and even from the point of view of the unsentimental financial committee, the Electrical Department is regarded with great interest, and every one in touch with the administration appreciates the fact that the nightly gate receipts of the exposition will be very largely affected by the magnificence of the electrical exhibit.

The intense rivalry that has grown up among exhibitors has served only as a stimulus to each and all of them to do their very best. One thing that has created more than usual interest in this section has been the fact that Prof. Barrett, Chief of the Department, has met with the most violent opposition to his plans from various interested sources, and because the electrical people and the electrical press have been put upon their mettle in helping to fight his battles. Without an exception those directly interested in the electrical industries have endorsed and sustained Prof. Barrett's attitude on every point, and whatever success is achieved in this section of the exhibition will be felt as almost a personal success by every electrician and every electrical journal in this country. It is no longer a question of how great the exhibition in the electrical section will be. The only question is what exhibits will be admitted and what exhibits will have to give way. Almost the entire space at the disposal of the department has been applied for.

The extremely liberal policy of the exposition management in declining to charge exhibitors for space, as is usually done, must of necessity carry with it a somewhat arbitrary power on the part of the Chief of the department in the allotment of this space. Many persons, noting that they will have no charges to pay for space, naturally ask for more than they would consider necessary had it to be paid for, and in justice to all, Prof. Barrett will have to exercise a very careful judgment in holding exhibitors within reasonable bounds. There is not an electrical manufacturer or inventor in this country who will not want space at the exposition. The governments of Europe, through their commissioners appointed for the purpose, have notified the management that they will want a liberal allotment of space. This is especially the case with England, France and Germany, and it has now become an established fact that for the first time the electrical manufacturers of this country will have to enter into direct competition with the manufacturers of Europe. Our own people are keenly alive to their superiority over Europeans in the practical application of electricity, and on the other hand, European manufacturers believe their position impregnable along the lines of artistic and ornamental work and in the fine finish and durablility of their machinery. The expositions that have been held heretofore have brought these two classes of manufacturers just closely enough in touch with each other to make each appreciate the merits of the other's work, and in preparing for the Columbian Exposition all of them will exhaust their resources in the perfection of their arrangements. There is a very general feeling among electrical manufacturers that expositions are becoming too common, and that the expense of taking part in them so frequently is by no means commensurate with the return obtained. It is coming to be a commonly expressed decision among the electrical people, that they will make their best efforts at the World's Fair, and that they will then refrain from exhibitions, at least for a long time.

Another thing that promises to make the electrical section of more than usual interest is the international electrical congress which it is contemplated to convene some time during the exposition. This congress, it is hoped, will bring to Chicago all the great scientists in the world, and will be the occasion of the final settlement of international standards and units and of a reconstruction of the electrical nomenclature. In addition to this congress of scientists it is contemplated to have special sessions of all the different societies of electrical engineers, and of the different electrical associations. These being held at the same time as the scientific congress (probably during the month of August or September) will make an electrical *omnium gatherum* for a month or so during which the exposition and Chicago will belong to the electrical people.

The Committee on Awards of the National Commission has now in course of preparation a magnificent scheme of awards in the Electrical Department, and this too will act as a great stimulus when the plans of the Commission are finally published, showing the extent to which the United States Government contemplates going in the matter of awards. There will be probably five juries for making awards in the electrical section, each composed of seven men selected from all over the world as being especially competent to pass upon the exhibits in the various branches to which they may be assigned. Whether awards are to be made in the shape of gold medals with diplomas or parchment certificates, or both, has not yet been determined, but this question is now under discussion by the committee on Awards. It is contemplated, however, to have each jury in each of the groups of every department make exhaustive reports of tests which may be made by them, and these reports, which will be printed in book form by the United States Government, are designed to be of very great interest to manufacturers and those interested in the efficiency of electrical machinery.

It is given out by the Department of Electricity that nearly all of the vexed questions connected with the exhibition have been settled, especially those with reference to foreign exhibitors. From now on, the work will unquestionably be very largely of detail, and Prof. Barrett's good judgment will be brought into play in aid of those exhibitors who will require advice in the matter of preparation and installation of their exhibits. A great fund of information has been accumulated for the benefit of exhibitors by the Department

of Electricity, and in a short time this will be promulgated in pamphlet form, for the guidance of the electrical fraternity.

A PYRO-MAGNETIC PENDULUM.

A curious scientific toy was recently exhibited at a meeting of the Royal Society in London. It is a heat engine, based upon the principle that nickel, magnetic at ordinary temperatures, promptly becomes non-magnetic at a temperature of 572° F. The construction of the engine is as follows: A disc of copper is suspended by two strings so that it can swing like a pendulum. Mounted on the copper disc is a magnet which holds up a piece of nickel. An alcohol lamp placed below the disc heats the nickel until it becomes demagnetized and drops away, when the copper pendulum makes an oscillation. During this oscillation the nickel cools sufficiently to regain its magnetic character and is caught up by the swinging magnet only to be passed again over the lamp which causes it again to drop, and so on, the pendulum being thus kept in motion.

GOVERNMENT CONTROL OF TELEGRAPHS.

Mr. E. Rosewater, of the *Omaha Bee*, gave an exhaustive description of The Government Telegraphs of Europe before the New York Electric Club on Dec. 3. Mr. Rosewater is of opinion that the postal system of this country can not attain its full measure of usefulness and efficiency until the electric telegraph and long distance telephone have been made an integral part of the post office system, with the pneumatic tube service as an auxiliary for conveying letters and messages in our great centres of population. In the early part of his lecture Mr. Rosewater outlined the remarkable increase that has taken place in the number of postal telegraph messages in Great Britain since 1870. From 9,850,177 in that year the number has increased to 62,403,399 in 1890 1.

This vast volume of telegrams is handled by the British postal telegraph department with promptness and marvellous accuracy. In London the city messages are transmitted exclusively by pneumatic tubes, which extend in every direction from the general postoffice. Thousands of dispatches, letters and postal cards are shot by air pressure every hour of the day from the twenty postal tube stations situated at the most accessible points into the Central Telegraph station, and there they are redistributed and forced back to other stations, whence they are delivered by carrier or forwarded by telegraph or telephone to points outside of London. The tubes have not only enabled the postal authorities to transmit the dispatches and city letters in London more rapidly than they could be forwarded by wire, but they have done away with the costly and inefficient local wire service, and, in a measure with the pole and wire nuisance. But to the public, the greatest benefit of the tube system is its cheapness.

In New York or Chicago a city message of ten words or less costs twenty cents, In London as many words as can be written on the blank or card, which varies from 100 to 1,000 words, can be sent for twelve and one-half cents, and what is also of importance, the message will be delivered almost before the girl that usually acts as operator in the hotels or local offices in our cities would have time to copy it. An important advantage in the tube system is that no copying is done--the original message is delivered to the person to whom it is directed, unless it is to go by telegraph or telephone to points beyond London. A telegram with the proper stamp attached, dropped into a postoffice in any city in Great Britain, will be wired from the nearest telegraph station just the same as if the sender had gone through the tedious formality of handing it directly to the receiving clerk at the telegraph office.

Mr. Rosewater explained at some length the working of the government telegraph in Germany, and as proof that the government telegraph departments utilize all new inventions more promptly than do the American private companies, stated that in Berlin the Hughes printing instrument has the preference and one hundred of these are used in the central telegraph station. Delany's multiplex, an American invention, has for several years been in active use in England, where it has been improved in several points of detail and the inventor and patentee received $100,000 and $10,000 royalty per year from the British government. So far, this useful invention, which greatly increased the capacity of the wires, has met with no recognition at the hands of the American telegraph companies. One of the novelties introduced at Berlin is the use of an accumulator battery. This battery consists of 120 cells divided into three sections of forty each; only two of these sections are in use at any one time. A steady current is obtained and no variation has been noted during the ten months that they have been in use.

The impression has prevailed in this country that the postal telegraph service of Europe does not afford as good facilities and such cheap rates to the press as do the telegraph lines of America. This idea, Mr. Rosewater found, was entirely erroneous. While the British Postal Telegraph does not permit preference in the transmission of dispatches to any patron, the press dispatches are transmitted over special wires. The lecturer stated that the efficiency of the method of handling press dispatches in London surpassed anything he had ever seen. Reporters and correspondents file their dispatches, inclosed in special envelopes, directed to the Intelligence Bureau; they are immediately shot into the central telegraph building and transferred through a pneumatic tube to the Intelligence Bureau.

There the envelope is opened, the dispatch is checked, and at once transmitted by special wire, or by telephone, as the sender may direct. Press dispatches may be duplicated to any number of papers, and parliamentary proceedings and other general news dispatches are often wired simultaneously to 200 or 300 different papers. The rates are lower than the most favorable contract that any telegraph company has ever granted to the Associated Press or any other association in this country. For instance, each paper in an association of twenty-five dailies would pay only forty-eight and two fifths cents for 1,000 words of night report and fifty-nine and two-thirds cents for 1,000 words of day report, while 10,000 words of night report would cost $4.84 and 10,000 words of day report $5.93 for each paper.

One of the strongest arguments advanced against the introduction of a government telegraph system in this country is set forth in the possibilities it would open up for political corruption. It was refreshing to hear from Mr. Rosewater that in every country he visited the telegraph service was kept free from politics. No case in which anybody in the telegraphic service had suffered in any way on account of his political opinions had come under his notice. The employees were amused even at the idea of such a thing. At the great telegraphic centre of Swansea, in Wales, the superintendent told him that he and a large proportion of the working force were ardent Radicals and strongly opposed to the Salisbury Ministry, but the idea that their places could be endangered or their work interfered with on this account never entered into their heads. At the Berlin office a furious Socialist occupied an important place in the service. This man was not merely hostile to the Government, but to the very form of the government, and yet, so long as he did his work faithfully, he could not be disturbed. At the same time the telegraph employees are expected to refrain from active political work, either on the stump or elsewhere, as this might lead them into abuse or depreciation of their superior officers, and consequent destruction of discipline.

Mr. Rosewater paid a high tribute to the skill of American telegraph operators. He considers, after careful inspection of the postal telegraph in the first cities of Europe that the most skillful telegraphers in the world are in America. One of our first-class operators, he thinks, does fully as much work in a given time as is done in London, Paris, or Berlin by two operators. On the other hand, the European telegraphers as a class have a higher education and are not only fitted to manipulate instruments and transmit despatches, but to supervise other branches of the postal service. This feature has made the telegraph the stepping stone to important positions in the civil service that are directly or indirectly connected with the postal system.

An interesting fact to which Mr. Rosewater referred in the course of his lecture is that in Austria the bulk of all press dispatches are transmitted by long distance telephone, which is part of the postal telegraph plant in that country. This is also true of Germany. All the press dispatches between Vienna and Prague, a distance of nearly 300 miles, are transmitted by telephone at rates computed according to the time consumed.

After the lecture the subject was warmly discussed, the general tenor of the remarks of the speakers being that although Government control of telegraphs might be an excellent thing for European countries, it was an experiment the success of which in this country would be very doubtful.

BOOK REVIEW.

Modern Practice of the Electric Telegraph. A Technical Handbook for Electricians, Managers and Operators. By Franklin Leonard Pope. Fourteenth Edition. New York, D. VanNostrand Company; London, Sampson, Low, Marston & Co. Price $1.50.

This excellent work and its author are so well and favorably known to the electrical fraternity that neither need introduction. The present edition has been entirely rewritten, enlarged and brought up to date, and some new features have been introduced. One of these that will be received with favor are the short biographical sketches of men who have distinguished themselves in electrical science. Although the subtitle of the work describes it as a *technical* handbook, it is not such in the ordinary acceptation of the term, but is singularly free from technicalities; it is popular in style and within the grasp of everyone. Mathematics, that stumbling block to so many who have use for a book such as this, has been rendered unnecessary by the free use of concrete examples, illustrative of methods and processes of arithmetical computation available in electrical investigations.

The book is copiously illustrated, well indexed and will constitute a *vade mecum* for telegraph operators and others for whom it is designed.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The electricity committee decided some time ago to carve the names of sixty-three eminent electricians of bygone days on the electricity building. A careful search of the records revealed the fact that this could not be done without, as one member of the committee expressed it, "killing off about a score of electricians now living." Then the committee reduced the number to forty-one. The names of these were published in a late number of Electricity. Among them was the name of Dr. Channing, of Pasadena, Cal. When Dr. Channing saw that his name was to be in-

scribed among the departed electricians he wrote to a friend, modestly stating that for the present, at least, he prefers to be omitted from the list of the distinguished dead, even though his name should be written in marble. His request will be granted.

One of the exhibits that the Baltimore & Ohio Railway Company expect to show in the electricity building is a model of the first telegraph wire laid down along that line by Morse. The line was nine miles long and extended from Baltimore to Relay Station. The wire was laid in a lead pipe, and the man who made the plow to dig the trench for the pipe is still alive.

It is probable that gas may be used as fuel on the Exposition grounds. One of Chief Burnham's assistants is making a scientific investigation of the subject and will report the result of his researches in a short time. Oil was proposed as a substitute for coal, but it has been rejected on account of the unpleasant odors that attend its burning. Chief Burnham hesitates to use coal, for the reason that trouble would be experienced in storing the quantities that will be required. A recent estimate showed that 1,000 tons a day, or 180,000 tons in all, would be needed to furnish power for all the machinery. Another objection to coal is the danger from fire that attends the storing of such large quantities. Two representatives of the united gas industries of the United States yesterday applied for space on the grounds to exhibit the process of manufacturing gas. No action was taken on their application, and nothing will be done until Mr. Burnham decides what kind of fuel shall be used.

Work on all the buildings of the Columbian Exposition has been pushed so rapidly that a visitor to the grounds can gain a fair idea of the shape, size and position of each. The Women's Building is the farthest advanced, having arrived at the stage of applying the staff and mortar for the outside covering. The Electricity Building up to the present time has been very slow in assuming definite shape, but the contractors say that from now on it will be pushed rapidly to completion. Nearly all the joists for the second story flooring have been laid. Most of the iron work for the roof has arrived on the ground and will be raised into position immediately.

Electric lights have been hung in nearly all the buildings so that work may be continued after dark, when necessary. A number of new arc lamps have arrived and will be distributed about the grounds and buildings.

Two arc light dynamos, of the Edison type, each having a capacity of 50 lights, arrived on the grounds this week. They are to be used for supplying current to the new circuits that have recently been added to the plant. The temporary electric light plant now consists of two power generators, four 50 light arc and two 250 light incandescent machines.

The Cook Well Company, of St. Louis, is sinking a drive well in the boiler room of the power plant. The well is to be an eight inch bore and will be driven down till fresh water is obtained, which will be probably at a depth of a couple of hundred feet.

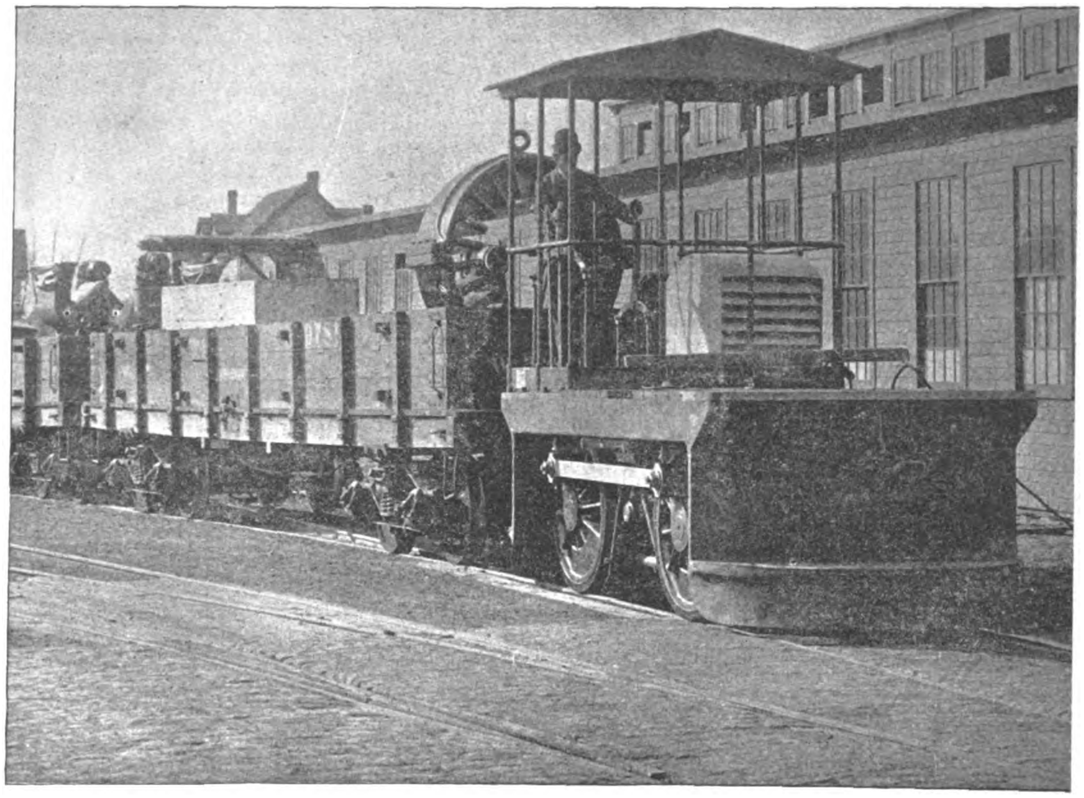
THE PULLMAN CENTRE-VESTIBULE TOP SEAT CAR.

The Pullman double decked car,* which is now running on the West End Railway, between Bowdoin Square and Cambridge, is a success. The slight changes and alterations which were found necessary after the first trip were speedily and easily made. The car now makes regular trips daily, and is patronized by all who can find a seat in its luxurious interior or on its lofty upper deck. Last Friday morning the Cambridge City Council made an extended trip in it, and during the afternoon Mr. H. M. Whitney, President of the West End Railway, took Governor Russell, Mayor Matthews and other members of the State and City legislatures for a long ride, and all were more than pleased with the comfortable and capacious accommodation provided. While the car is, if anything, a shade too long to take some of the very sharp curves in Boston with ease, it is likely that quite a number will be ordered to conform to the extreme difficulties on our street track. The new car is a great favorite, and the travelling public is simply delighted with it.

* See ELECTRICITY for October 14, 1891.

THE THOMSON-HOUSTON ELECTRIC LOCOMOTIVE.

Much has been said in regard to the substitution of the electric motor for the steam locomotive, and its feasibility has both been demonstrated and called in question on paper. Managers of steam railways have not heretofore had sufficient confidence in the practicability of the change to try the experiment, nor have our electrical manufacturing firms cared until recently to undertake the job on a guaranty that would be satisfactory to their customers. It was an event therefore of no small interest—the testing of a full-fledged electric switching locomotive—that called to Lynn, a few days ago, some 60 gentlemen, to witness the first invasion by electricity of a domain hitherto exclusively occupied by the steam locomotive.



THE THOMSON-HOUSTON ELECTRIC LOCOMOTIVE.

The road that rendered this experiment possible is that owned by the Whitin Machine Co., of Whitinsville, Mass., who intend to employ the machine to carry their merchandise back and forth from the railway station to their works, a distance of 2½ miles, and the Thomson-Houston Co., who were entrusted with the duty of designing and constructing the locomotive, are responsible for the success which seems to have attended this the first attempt to really supplant the steam locomotive in its own territory by the electric motor.

The locomotive is equipped with one double reduction motor of 100 h.p. geared to one axle and well housed in. The driving wheels on this axle are connected with those on the other axle by means of connecting rods as in steam locomotive practice, and the speed and direction are regulated by controlling levers in the cab. The gearing consists of aluminum bronze pinions working into wrought iron gear wheels. On the intermediate shaft is keyed an iron brake drum. This is lagged with wood and embraced by two steel brake bands controlled by levers in the cab. Current is received from an overhead conductor through an universal trolley (not shown in the engraving) similar in form to those employed by the Thomson-VanDepoele Mining Co. on their mining locomotives, which permits of change of direction of the locomotive without re-adjustment of the trolley.

In the trial at Lynn the locomotive was at first operated from a short line of overhead conductor, but desiring to lengthen the trip beyond the limits of the overhead wire, a long cable, connected with the source of current and lying along the side of the track, was called into service as a trolley wire, from which current was taken by an improvised trolley. The photograph represents the machine taking current in this way. The severest test was the drawing of six cars, having a total weight of 163 tons, which was accomplished to the satisfaction of all concerned. The capacity of the locomotive is said to be sufficient to draw 100 tons up a 3 per cent. grade, but the maximum grade encountered during this trial was one of 1½ per cent.

Appended are the more important electrical and mechanical data concerning the new locomotive.

Voltage of current employed	500
Horse power at draw bar	100
Speed on level track when developing above power	5 miles per hour
Wheel base	6 ft. 4 in.
Diameter of wheels	42 in.
Speed reduction between armature and axle	1 to 25
Gauge	4 ft. 8½ in. (standard)
Wheel base	6 ft. 4 in.
Measured height above rail platform	4 ft. 4 in.
Greatest length of locomotive (at cowcatcher)	15 ft. 9½ in.
Greatest length of platform	12 ft. 7¼ in.
Greatest width of platform	7 ft. ¼ in.
Weight of complete locomotive base less trolley pole	42525 lbs.
Approximate weight of motor	5400 lbs.

Double acting sand boxes, spring draw-head, standard link coupling, band brake on brake drum on intermediate shaft.

The designing, building and testing of this machine have been under the supervision of J. P. B. Fiske, of the Lynn factory, who has charge of all the varied motor work of the company, except the railway and long distance transmission.

A CORRECTION.

Mr. George E. Dorman, electrician of the Standard Electric Co. writes to say that the electrical plant of the "Fair" building, described in Electricity for November 25, was furnished by the Standard Electric Co. and all the dynamos were designed by Mr. Dorman.

ANSWERS TO CORRESPONDENTS.

Subscribers to Electricity *are invited to make use of this column whenever electrical questions of general interest arise. Where apparatus is concerned, full details should be given. It will be the aim of* Electricity *to answer all legitimate queries of an electrical nature in as clear and untechnical a manner as possible, and thus to make this column a friendly guide to those of its readers who may desire such assistance. Inquiries should be accompanied by the full name of the writer—not necessarily for publication, but for our own information and should be addressed to the Editor of* Electricity.

Will you please inform me through your paper how the regulating tube of an ordinary medical induction coil is arranged, also how to make a cheap spark coil for ordinary gas lighting?
F. G., Columbus, O.

1. The regulating tube of the medical induction coil is usually made of soft iron and sufficiently large to slip over the coil. When the whole is enclosed in this tube the induction in the tube about equals that in the secondary coil and by secondary induction counterbalances or neutralizes the currents induced in the secondary. As the tube is withdrawn it becomes less and less subject to the inductive influences of the core and its opposing effect on the currents in the secondary becomes correspondingly less until it is pulled entirely out, when it is nil and the maximum secondary or Faradic current is obtained.

2. A spark coil for gas lighting is constructed in the same way exactly as the induction coil of a medical battery, except that there is no regulating tube and the interrupter is usually omitted. It consists of a core of soft iron wires around which is wound a coil of insulated wire of low resistance, called the primary, and this is surrounded by another coil of many turns of fine wire for a secondary. For lighting gas the coil should be large—say eight or ten inches long with a core $\frac{1}{2}$ to $\frac{2}{3}$ inches in diameter. The primary coil may consist of one or two layers of say No. 20 insulated wire, and the secondary of a number of layers of any finer wire—within limits the finer the wire and the more turns there are on the secondary, the longer will be the spark. On medical coils the secondary wire is usually extremely fine. For spark coils it is not best to use such fine wire as it is liable to get broken in handling. If a current be passed through the primary coil and be suddenly broken, at the moment of break an induced current of high potential will flow through the secondary, which takes the form of a spark if there be a small air gap in the circuit connected to the secondary coil.

1. Will you please advise me as to what sized wire I should use on an induction coil? I have a spool 6 inches long and $1\frac{1}{4}$ inches deep between flanges out of which I would like to make an induction coil. Give size of primary and secondary wires, and about how much of each?

2. Would it be better to use a solid iron core or to make it out of iron wire? Give size of wire.

3. How is a dry battery made?

1. The rule is that the electro-motive force in the secondary coil bears the same relation to that in the primary coil as the resistance of the secondary coil does to the resistance of the primary coil. If it is desired to produce a very hi h potential in the secondary coil from a low potential (such as is obtained from a single cell) in the primary, the resistance of the former must be many times that of the latter. This is usually accomplished by employing a much finer wire in the secondary and giving it many more turns than the primary. So long as this principle is followed it makes no difference so far as results are concerned what sized wires are used in either coil.

Means must be provided for interrupting the primary current. If you will examine the means employed to interrupt the current in the common electric bell, it will give you a much better idea of how to accomplish it than we could give you in these columns. See answer to F. G.'s question on the same subject.

2. The core should not be solid. Make it of a bundle of soft annealed iron wire, size about No. 18.

3. For a dry battery the same elements may be used as in the wet, but the exciting fluid is mixed with some substance which will form a gelatinous mass. For instance, for a zinc-carbon, sal-ammoniac cell, add to a concentrated solution of sal-ammoniac sufficient gelatine so that when cold it will set to a jelly—not too stiff. While this is still warm and therefore liquid, pour it into a jar containing the zinc and carbon electrodes and allow to stand until cool. The cell will then be ready for use. In making the jelly it is well to add a small quantity of some deliquescent salt, such as quick lime, or better still, magnesium chloride. This has such an affinity for moisture that it will absorb it from the atmosphere, thus always keeping the jelly moist enough for efficient action.

SAFETY DEVICES.

Mr. C. C. Haskins read an interesting paper before the Chicago Electric Club last Monday evening, taking as his theme "Safety Devices."

After discussing the melting points of metals and their alloys, and showing that strips of the latter could be constructed to melt at any temperature between 212° Fahrenheit and a much higher point, he proceeded to show that in most cases, if a proper sized fuse were used, it afforded an absolute safeguard against overheating of conductors.

The lack of trustworthy data as regards the safe carrying capacities of conductors was referred to as one of the evils to be remedied before absolute certainty could be attained, and the incorrectness of fuse marks as another. The lecturer cited one case where a fuse marked to blow with more than one light in circuit did not melt until $2\frac{1}{2}$ amperes had passed through it; and another case where a fuse marked 15 (which might mean 15 lamps or 15 amperes), did not give out with less than than 30 amperes.

As a remedy for this he considers it essential that some uniform standard of fuse should be adopted by the proper authorities, and that none others be permitted to be used. Each fuse should be plainly marked with its carrying capacity, and the cut out block should be so constructed that only the strip for which it is marked could be used with it. That is, a 10 ampere block should not be capable of holding a 20 or 40 ampere strip.

Though a properly proportioned strip is usually a good safeguard, Mr. Haskins cited two instances where the man in charge intending to stop his motor had not turned the rheostat switch completely off, and in both cases fire resulted although the safety strip had not fused. He recommended that all such switches be so constructed that they could not be left at any intermediate point between "on" and "off."

The paper was listened to with attention, and at its close a general discussion took place, in which Messrs. Bain, Cutter and Wirt gave the meeting the benefit of their experience.

THE SERIES ELECTRIC TRACTION QUESTION.

BY NELSON W. PERRY, E. M.

I have read with interest Mr. G. C. Courtney's kindly criticism on my article on "The Future of Electric Railways" that appeared in your journal for October 21. In advocating the series method I did so with a full knowledge of the difficulties in the way of its adoption in the present state of development, and cited some of these to indicate the lines on which invention should proceed in order that the system might be put on a practical basis. I quite agree with Mr. Courtney in his statement that "with a given potential there is just as much loss in a series as in a multiple system," but the point I made was that in the series system there was no drop in potential at the end of the line, however long it might be and however many cars were being operated, provided, of course, that the work performed did not exceed the capacity of the generating plant. This is a serious defect in multiple arc distribution, the only remedy being the employment, very uneconomically, especially in street railway work, of large quantities of copper. It is a remedy, too, that is but partial and not radical.

Mr. Courtney states that there is a limit to the potential which can be produced with safety in a series dynamo. Quite true, but that limit in a series distribution is far beyond the safe limit in multiple arc circuits. If we consider the difference of potential at the terminals of the dynamo alone, the limit of safety is the same for both, but in the series system the danger due to this potential is confined to the generating station, with which the public have nothing to do; whereas with the multiple arc, it extends to every translating device on the line, with which the public certainly is concerned. For instance, on a series arc light circuit, the difference of potential between the generator brushes might be 1,000 volts, but a person may trim a lamp on any portion of the circuit without subjecting himself to more than 45 or 50 volts pressure, whereas on a multiple arc circuit with the same potential, no translating device on the line, however insignificant, could be handled without subjecting the operator to the danger of a shock as severe as he would get in the generating station, *viz.* one due to 1,000 volts.

Mr. Courtney also states that "running dynamos in series commercially, is not advisable." I do not know why it is not advisable. Certainly the connecting up of series dynamos in series with each other is as simple as coupling up galvanic cells in the same way and they work with great efficiency when so arranged. The only objection that occurs to me is the increased electromotive force that can be obtained by this arrangement, and I suppose this is what Mr. Courtney had in mind, but when we remember that the electromotive force in the dynamo room is strictly proportional to the work performed on the external circuit, while the danger in handling the motors on the line is only proportional to the work performed by each individual motor (provided, of course, that there be no grounds on the line), it will be apparent that it is immaterial whether we employ one large generator or its equivalent in smaller ones joined in series.

The alternating current system with high potentials in the primaries and low potentials in the working circuits, suggested by Mr. Courtney, certainly has its advantages but also its disadvantages. A transformer system is specially adapted to long transmissions, where the loads are constant and the transformers are working to their maximum capacity. Its efficiency, however, decreases with enormous rapidity as the load falls short of this. In street railway practice, the demands along the line fluctuate between zero and a maximum very far in excess of the mean. The transformers would have to be made sufficiently large to supply abnormal demands, and if of sufficient capacity to meet these requirements, their mean efficiency would necessarily be extremely low. I think it would be safe to say that a transformer system as applied to the average street railway, could not give a mean efficiency greater than 35 or 40 per cent. Then again, the single phase alternating motor that will start with load has not yet been built. It is very probable that it will be built sometime, but from some recent developments in the series system with which I am familiar, it now seems probable that its defects will be corrected before the alternating current motor comes into existence. If this be so, I am still of the opinion that the series system for long transmissions will be the best for vehicle propulsion.

FROM NEWS CENTRES.

NEW YORK.

New York, Dec. 3.—The failure of Field, Lindley, Wiechers & Co. has been the sensation in Wall Street this week. One of the immediate results of this event is the granting in the Supreme Court of an injunction, on the application of

Frank J. Sprague, the well known electrical engineer, restraining the insolvent firm and its assignees from disposing of certain shares of the Edison General Electric Company's stock. The Edison General Electric Company and E. A Hussey are also made defendants. On Nov. 4 Mr. Sprague secured a loan of $25.000 from Field, Lindley, Wiechers & Co., giving as collateral 300 shares of Edison general stock, which was then worth 98 or 99. The loan was for six months. It is said that the shares were sold by the firm the same day, the transferee being E. A. Hussey, a Broadway broker. The amount realized by the sale was nearly $5,000 in excess of the loan for which they stood. The next day Mr. Sprague was called on for an additional margin. Not having watched the fluctuations, he deposited an additional fifty shares. These facts have only just come out, and the injunction proceedings are the consequence. It is stated that 200 of the shares still stand in the name of Mr. Hussey; one hundred have been disposed of to other parties, and fifty shares still stand in the name of the firm with which they were placed as collateral.

Nearly all the stock of the United States and the Consolidated Electric Lighting Companies has been acquired by the Westinghouse Company under its reorganization. The saving in interest on debts, rentals and other fixed charges effected by the new arrangement of the company's affairs amounts to more than $400,000 a year.

The slot in the cable conduits in Broadway is a source of considerable apprehension to drivers of light wagons. Several accidents have lately been reported owing to the wheels of vehicles having been caught in the slot. After careful measurement the slot has been pronounced unsafe, and a general caution to drivers, based on this decision, has been issued.

The periodical report about a consolidation of the American District Telegraph and Mutual District Messenger Companies has again been started. Superintendent G. B. V. Frost, of the American District Company, denies the report. He says there has been talk for the last ten years about this consolidation, but nothing has yet been done. It is thought that the merging of the two companies might increase the efficiency of the service, but there are obstacles in the way which have up to this time proved insuperable.

Further changes in the engineering department of the Rapid Transit Commission are rumored. Last week Chief Engineer W. E. Worthen was made consulting engineer, and now it is reported that John Bogart, State Engineer and Surveyor, is to be appointed to the office of Chief Engineer thus made vacant. Mr. Bogart will go out of his State office on Dec. 31, and the new appointment is supposed to date from that time. Mr. Bogart was one of the consulting engineers called upon by the commission to criticise the plans reported by Chief Engineer Worthen and Assistant Engineer Parsons. His report favored the Worthen plan while finding much to commend in the Parsons plan. Engineer Parsons is now engaged upon the surveys and work preliminary to the preparation of the working plans and specifications, in which he will have the assistance of Mr. Bogart and Mr. Worthen.

A perpetual injunction has been issued in the United States Circuit Court restraining the Electric Accumulator Company from making storage batteries in infringement of the patents of Charles F. Brush, now owned by the Consolidated Electric Storage Company; the successors of the Julien Electric Company. G. H. G.

BOSTON.

BOSTON, Dec. 3. The Naumkeag Street Railway and the Essex Electric Street Railway Cos., whose combined systems cover the entire territory of Salem, Peabody, Marblehead, Hamilton, Wenham, Beverly and Danvers, have become one and in future will be operated under the same management. This is a very important deal and is likely to be followed soon by extensive alterations and improvements.

Electric cars began to run through Washington street, the main business thoroughfare in Boston, last Saturday, and as the cars are of the long six and eight wheeled type they carry big loads of passengers every trip. On the various sections recently equipped electrically the few horse cars which have to run over the electric tracks to reach those sections not yet so equipped are well nigh deserted, the travelling public showing a decided preference for the electrics.

The Thomson-Houston Electric Co. is to build an electric street railway in Hopkinsville, Ky., the contract price for which is said to be $75,000.

The street railway at Norwich, Conn., is to be equipped by electricity as soon as the city council grants the company authority to make the change.

The Ashton Valve Co., of Boston, is constantly bringing out improvements intended to ensure greater economy and safety in the use of steam power. Its last novelty is a marine pop-safety valve with extension lever. This lever is so arranged that weights can be attached to the end of it, to lighten the downward pressure of the spring on the valve. With this device the safety valve can be conveniently made to blow off at any lower pressure desired, without having to take the valve apart or to change the interior adjustment. This is found to be of great practical use to marine engineers.

Construction work is being pushed on the electrical equipment of the Boston and Lynn Railway. Mr. Charles L. Bly, who holds a contract for the work, has a large staff of men employed in stringing wires and erecting poles. An effort is being made to get the entire 1,500 poles erected before winter sets in. The same gentleman has just completed the work of installing the Municipal Police Signal System in the city of Brockton, Mass.

The Edison Illuminating Co. is having a telephone exchange erected on the top floor of its Head Place station, so that by means of an operator who will always be on duty, communication can be promptly had with the other stations or with any employe who may be at work on the lines in any section of the city.

The movement in favor of the organization of a New England Electric Club in this city is meeting with very general support and it looks as if the project will be successfully carried through.

Haverhill and Lawrence, Mass., are soon to be connected by an electric railway, a very rich company having become interested in the undertaking. This company includes ex-Gov. Ames and F. L. Ames, two of the richest men in Massachusetts. W. S. K.

MONTREAL.

MONTREAL, Nov. 28th.—A step forward in electrical interests in Canada has been taken by the formation of a Canadian Electrical Association at Toronto. This event, which took place Nov. 26th, is one of the results which may undoubtedly be traced to the recent Convention in Montreal. That convention stimulated our people in many ways. Although Canadians, as Mr. Corriveau remarked some time ago, would perhaps derive more benefit from co-operation with the N. E. L. A., yet a Canadian society, having regard especially to our own electrical industries, must prove of lasting value. It is the purpose of the new Association to hold annual meetings, the first to be held at Hamilton, Ont., on the second Tuesday in June, 1892. At the meeting for organization almost every branch of electrical industry was represented. The following gentlemen were elected as a board of officers: J. J. Wright, President; H. J. Dunstan, first vice-Pres.; John Carroll, second vice-Pres.; C. H. Mortimer, Secretary and Treasurer; E. S. Edmonson, H. O. Fisk, W. A. Johnston, S. J. Parker, A. B. Smith, A. Thomson, Thos. H. Wadland, A. A. Wright (Renfrew) and John Yule, Executive Committee.

It is rumored that the Canadian Pacific Railway Co. are intending to start a telephone company in Montreal in opposition to the Bell.

Mr. W. C. McDonald, the generous donor of the electrical engineering outfit of McGill University, has lately given 295 volumes to the college library, comprising leading works on industrial electricity by English, French and German writers.

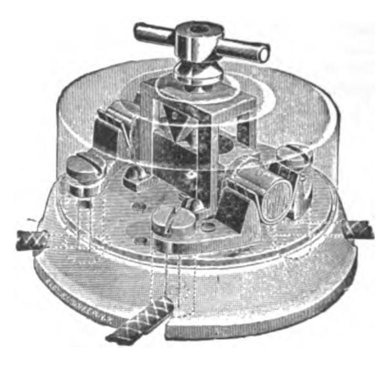
The Royal Electric Light Co., of Montreal, has lately installed two new alternating current dynamos to meet the increasing demand for incandescent lights. They have also rebuilt the city switchboard, and are building further additions to their power plant.

The Intercolonial Railway Co. has just made a purchase of 100 Julien storage cells from T. W. Ness, the Montreal agent.

The Edison General Electric Co. supplied some handsome electroliers and fittings for L. E. N. Pratt's piano warerooms. The wiring was done by T. W. Ness and current is supplied by the Royal Electric Co. H. T. B.

THE NEW ENGLAND SWITCH.

This double pole switch, illustrated below, which is placed on the western market by the Electric Appliance Co., of Chicago, has several features of merit. The contacts are copper brushes, backed up by German silver to increase their resiliency; when the switch is closed these contacts are forced between lugs and securely held by the cam. It is impossible to open the switch without turning the handle, when the break is very sharp. The switch is made of the best quality of material, is simple in construction, neat in appearance and very durable. It is made with



porcelain base in sizes from 10 to 50 amperes, and with slate base from 50 to 100 amperes.

THE "NEW ERA" ELECTRIC GAS BURNER.

The accompanying illustration shows a new electrically-lighted gas burner invented by Mr. Horace A. Pinkham, of Boston, and christened by him the "New Era." The electric spark which ignites the gas is produced at the moment of opening the key which turns on the gas, in the following manner. One electrode is held by a standard attached to the burner in the usual way, provided with a binding post for the connection to the battery circuit. A loose core secured to

THE "NEW ERA" BURNER.

the burner by a brass collar and surrounded by a spiral spring of German silver provides the other electrode. When the gas is turned on a cam forces the core up and compresses the spring, thereby bringing the two electrodes into contact and producing the spark. When the spark is formed the cam has reached its highest point, the movable core falls back and the electrodes are separated again. One movement of the key turns on the gas and lights it; the height of the flame can then be regulated in the ordinary way by turning the key back. The American Electric Co., of Boston, have purchased the right to manufacture and sell this burner.

COMMERCIAL PARAGRAPHS.

The Electrical Construction Company, of Chicago, has closed the contract for a complete electric light plant in the new Lexington Hotel. The plant will consist of four 1,000-light incandescent machines and one arc light machine. The Lexington will be one of the finest and largest hotels in the city.

The Electric Appliance Company report having closed arrangements for the exclusive Western agency for the New England Switch, which is described elsewhere in this issue, and also for the entire line of specialties manufactured by the Consolidated Electric Manufacturing Company of Boston, some of which are the C. E. M. Jack-knife switches. C. E. M. Sockets, Wade Dynamo Register, O. R. W. Oil Filter, S. & W. Speed Indicator, Telescope Switch-board Plug, Davis Arc Cut-out and Corthell Lamp Adjuster. The Electric Appliacce Co. have now been made agents for quite a number of well-known specialties.

Mr. W. H. Eckert announces to the electrical industries that he has assumed the management of the long established and celebrated insulated wire and cable business of A. G. Day (S. A. Day, Successor), and that he is prepared to supply their wants in the line of high grade insulation. Kerite insulation has been used for a great number of years and sold to the largest extent of any insulation in the market.

The Buckeye Electric Co. have removed their western office from Jackson street to 437 Rookery building, where they have secured rooms in which to receive and entertain their old customers and new ones. Mr. C. H. Rockwell, general manager, was in the city this week for a few days enjoying the comforts of the new office. He reports the incandescent lamp business as being exceedingly good. The orders received are far in excess of what they are able to supply in their present quarters. The new factory of the company will be ready for occupancy by the first of next January. After this date they will be able to supply lamps at the rate of 2,500 to 5,000 per day. The new factory will be a three story brick building, 100 feet long and 40 feet wide, with a separate boiler and engine room 40x80 feet, in which they will place for the present a 100 h.p. Cooper-Corliss engine, also a large steel tubular boiler of the Cleveland Ship Building Company's type. Three large C. & C. dynamos will be installed to generate current for lighting and testing purposes. When completed the Buckeye Company will have one of the most complete lamp manufacturing establishments in the country.

The Clark Electric Co., of 192 Broadway, New York, gained a silver medal at the sixtieth annual exhibition of the American Institute, for the Clark Electric Search Light. This search light was shown in operation throughout the exhibition and excited much interest, owing to the ease with which it is manipulated and its steadiness. The Clark Electric Co. make a specialty of arc lighting apparatus, in which they have made many improvements and their manufactures in this line have given them a very solid reputation.

Mr. W. Le Conte Stevens, writing to Mr. Edward Weston, Vice-president of the Weston Electrical Instrument Company, Newark, N. J., says that the Weston Standard Voltmeter is held in very high esteem in Germany. At a lecture recently attended by him at the Polytechnic School at Zurich, the lecturer, who was a member of the Testing Commission at the recent Frankfort Electrical Exhibition, said he had subjected the Weston Voltmeter to various tests and found it in the highest degree satisfactory—the best thing from America that was exhibited at Frankfort. As an illustration of the excellence of the magnet employed, he stated that an instrument having fallen accidentally on the floor, its subsequent indications were not affected more than ⅛ of 1 per cent. by the mishap.

A dividend of 5 per cent. was paid the stockholders of the Crocker-Wheeler Motor Co. Nov. 15 last. A reserve fund was created at the same time, and the balance of the profits was set aside for this fund.

The Elektron Manufacturing Company, Springfield, Mass., among other orders, have received one for four motors for Japan, an electric light plant for Mexico, and an electric light plant for China; also two dynamos and engines, combined on same base, for steamship lighting.

Ad incor

PERSONAL NOTES.

Lord Russell, of whose domestic tribulations the newspapers have been giving such delectable accounts, is an electrical man. He is a partner in the firm of Swinburne and Co., the head of which is Mr. James Swinburne, the well-known English electrician.

As noted in another column, Mr. W. H. Eckert has been appointed general agent for Day's Kerite. Mr. Eckert is well-known to electrical men all over the country through his long connection with telegraphy and telephony. He was formerly general manager of the Metropolitan Telephone and Telegraph Company.

Mr. P. L. Rose, manager of the Rose Electric Light Supply Company, of St. Louis, was in Chicago on a business trip this week.

The genial occupants of the New York office of the International Okonite Company recently entertained some of their friends at a little dinner at the New York Electric Club. The hosts were Capt. Candee, Mr. Manson, Mr. Cheever and Mr. McCoubray. Among the guests were Mr. B. R. Western and Mr. J. H. Williamson, of the Manufacturer's Advertising Bureau.

Mr. Louis Magee, who, for over three years, has been in Europe as the representative of the Thomson-Houston International Electric Co., arrived home last week and will remain in this country for several weeks.

Mr. W. S. Hathaway, Jr., has succeeded Mr. O. K. Stewart as treasurer of the Germania Electric Co., and for the time being has general management of the business.

INCORPORATIONS.

San Diego Electric Railway Company, San Diego, Cal.; capital stock, $250,000; to construct and operate a street railroad, to purchase rights and franchises owned by San Diego Car Company; promoters, J. A. Spreckles and A. B. Spreckles, of San Francisco, Cal.; E. S. Babcock and Chas. F. Hinde, of Coronado, Cal.; Joseph A. Flint, San Diego, Cal.

The Home Electric Company, New Brighton, Beaver Co., Pa.; capital stock, $10,000; supplying light, heat and power by means of electricity at the Borough of New Brighton and other boroughs adjacent thereto, etc.; promoters, L. Roggin Strobridge, Joseph E. Mitchell, N. N. Davidson.

The Morelton Electric Light and Power Company, Torresdale Mills, Bucks Co., Pa.; capital stock, $1,000: supplying light, heat and power or any of them by means of electricity to the public in Bensalem twp. Bucks Co., Pa.; promoters, Henry V. Massey, Torresdale, Edwin M. Thomas, Morelton, Joel H. De Victor, Andalusia, Pa.

The Bowling Green Electric Light and Power Company, Bowling Green, Ohio; capital stock, $50,000; promoters, Geo. S. Long, Joseph Schauer, E. H. McKnight, Jacob Henne, Sam. J. Miller.

The New England Heat Regulator and Electric Company, Portland, Maine; capital stock, $50,000; manufacture, use and deal in all kinds of electrical appliances; promoters, William Stopford, Joseph H. Wallis and Darling L. Trafton, all of Beverley, Mass.

Malvern Light and Power Co., Malvern, Mills Co., Iowa; capital stock, $10,000; furnishing steam power, steam heat and electric lights to the public and to private parties; promoters, J. D. Paddock, L. W. Boehner, Malvern, Iowa.

Litchfield Light, Heat and Power Co., Litchfield, Ill.; capital stock, $50,000; build and operate gas, electric and water works; promoters, H. H. Beach, J. B. W. Amsden and Robt. M. Foster.

Astoria District Messenger and Electrical Co., Astoria, Oregon; capital stock, $30,000; dealing in, managing and operating electrical, magnetic and other machinery for the purpose of transmitting messages and communicators; promoters, J. W. Crios, J. S. Urquhart, H. B. Loman, all of Astoria, Oregon.

Patton Motor Co., Portland, Oregon; capital stock, $50,000; to build, buy, sell and dispose of all kinds of electric motors and particularly that kind known as the Patton Electric Motor; promoters, W. W. Evans, Frank Dekum, John Hale, Cleveland Rockwell, R. L. Durham, all of Portland, Oregon.

The Electric Medical Process Company, Camden, N. J.; capital stock, $100,000; to manufacture, use and sell or lease to others the right to use medical electric appliances as manufactured by the company; promoters, W. Cohlman and R. M. Stackhouse, both of Philadelphia, Pa., and H. Troth, of Camden, N. J.

The Safety Electrical Company, Newark, N. J.; capital stock, $25,000; to manufacture, sell and deal in electrical supplies; promoters, A. Brosmel, F. Bralson, R. J. Brittian, all of Newark, N. J.

Electric Ore Reducing Company, San Francisco, Cal.; capital stock, $2,000,000; to reduce refractory ores by electric-chemical treatment under Monroe Thompson and other patents; to establish plants of machinery and operate same; to acquire mining claims and conduct a general milling business; promoters, Monroe Thompson, W. L. Brown, F. E. Brown, Jo. Gordon, S. B. Clark, all of San Francisco, Cal.

Electric Heat Alarm Company, Bangor, Maine; capital stock, $25,000; manufacturing and dealing in electrical appliances; promoters, E. L. Sterns, S. Palmer and Edward L. Stewart, all of Bangor, Maine.

Italian Motor and Power Co., Portland, Maine; capital stock, $500,000; generating, applying and in any manner using motive power of all kinds; promoters, Richard H. Coe, Boston, Mass.; Michele Russo, Boston, Mass.; D. W. Scribner, Portland, Maine.

Metropolitan Street Lighting Company of Omaha, Neb.; Omaha, Neb.; capital stock, $25,000; street lighting by gasoline and electricity in its various forms; promoters, Geo. J. Sternsdorff, Geo. E. Specht, Omaha, Neb.

The Shaver Telephone Company of Central New York; Syracuse or Watertown, N. Y.; capital stock, $30,000; to construct and use a line or lines of electric telegraph and telephone through counties of Onondaga, Oneida, Oswego, Lewis and Jefferson; promoters, George L. Davis, E. M. Gates, and J. B. Wise, all of Watertown, N. Y.

The Electro Medical Appliance Co., Chicago, Ill.; capital stock, $50,000; for the manufacture and sale of Electro-Medical Appliances; promoters, Robert R. Pryor, A. A. Hall and Frank D. Thomason.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DEC. 1, 1891.

DYNAMOS AND MOTORS.

464,025. Potential Indicator. Carl E. Kammeyer, Eau Claire, Wis. Application filed May 7, 1891.

464,026. Transformer and Armature Coil. Carl E. Kammeyer, Eau Claire, Wis. Application filed May 7, 1891.

464,027. Field Magnets for Dynamo or Motor. Carl E. Kammeyer, Eau Claire, Wis. Application filed May 7, 1891.

464,063. Electric Motor. Martin H. Cullom, Denver, Colo. Application filed Jan. 27.

464,090. Electric Apparatus for use on Railway Trains. Rufus A. Wilder, Cressona, Pa. Application filed Jan. 9, 1891.

464,136. Electric Regulator. Charles W. Holtzer and Geo. E. Cabot, Brookline, N. Y.

463,156. Electrical Generator. Victor Herbec, Paris, France. Application filed Nov. 6, 1890.

464,216. Armature for Dynamos and Motors. St. John V. Day, St. Louis, Mo. Application filed May, 1, 1890.

461,231. Electric Motor. John R. Robinson, Salem, assignor to Theodore F. Lawrence. Application filed Feb. 3, 1891.

ELECTRIC RAILWAYS.

464,002. Electric Brake. La Motte C. Atwood, St. Louis, Mo., assignor to the Atwood Electric Co. Application filed Feb. 27, 1891.

464,129. Crossing for Trolley Wires. Robert M. Jones, Salt Lake City, Utah. Application filed April 16, 1891.

464,332. Method of and Apparatus for the Propulsion of Trains. John B. Mahana, Freewater, Ore. Application filed Jan. 24, 1891.

461,370. Trolley Wheel for Electric Railway. Smith W. Kimble, Denver, Col. Application filed May 29, 1891.

464,371. Trolley Hanger. Smith W. Kimble, Denver, Colo. Application filed May 29, 1891.

464,378. Trolley Hanger. Thomas E. Adams, Cleveland, Ohio, assignor to Brush Electric Co. Application filed July 17, 1890.

ELECTRIC LAMPS.

464,005. Treating Filament for Incandescent Lamps. James Bradley, Massillon, Ohio. Application filed June 6, 1891.

464,132. Electric Arc Lamps. William M. Nickolson, N. Y. Application filed Apr. 23, 1891.

CONDUITS, CONDUCTORS AND INSULATORS.

464,022. Splice for Electric Conductors. William J. Hield, Minneapolis, Minn. Application filed May 15, 1891.

464,298. Electric Wire Support. Richard Ellison, Cincinnati, Ohio. Application filed May 18, 1891.

464,367. Insulating Composition. Smith W. Kimble, Denver, Colo. Application filed Feb. 24, 1891.

464,368. Insulating Support for Electrical Apparatus. Smith W. Kimble, Denver, Colo. Application filed Feb. 25, 1891.

464,369. Composition of Matter for Insulating Purposes. Smith W. Kimble, Denver, Colo. Application filed Feb. 26, 1891.

464,475. Joint for Electric Conductors. Henry W. Fisher Pittsburg, Pa. Application filed March 7, 1891.

TELEGRAPH AND TELEPHONES.

464,001. Telegraph-Repeater. Richard L. Atkinson, Delaware Township, N. J., assignor to John D. Tustin. Application filed March 27, 1891.

464,133. Relay. Richard Varley, Jr., Englewood, N. J. Application filed Feb. 10, 1891.

464,134. Electric Circuit Closer. Richard Varley, Jr., Englewood, N. J. Application filed Feb. 10, 1891.

464,152. Electric Transmitting Telephone. Rudolph Erickemeyer, Yonkers, N. Y Application filed May 23, 1883.

464,256. Watchman's Electric Recorder. Harvey Redding, assignor to Redding Electric Co., Boston, Mass. Application filed April 16, 1889.

MISCELLANEOUS.

464,034. Lineman's Vise. John McIsaac, Malden, Mass. Application filed July 6, 1891.

464,055. Electric Heater. Parvin Wright, Denver, Colo. Application filed March 21, 1890.

464,059. Photometer. Louis H. Barker, Williamsport, Pa. Application filed July 20, 1890.

464,125. Method of Testing Insulated Wires. Richard Varley, Jr., Englewood, N. J. Application filed Feb. 10. 1891.

464,159. Electric Toy. Olof E. Lundstedt, Brooklyn, N. Y., assignor to John M. Glover. Application filed Feb. 10, 1881.

464,244. Electric Fire Engine. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation. Application filed Feb. 9, 1891.

464,245. Electric Horse Carriage. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation. Application filed Feb. 24, 1891.

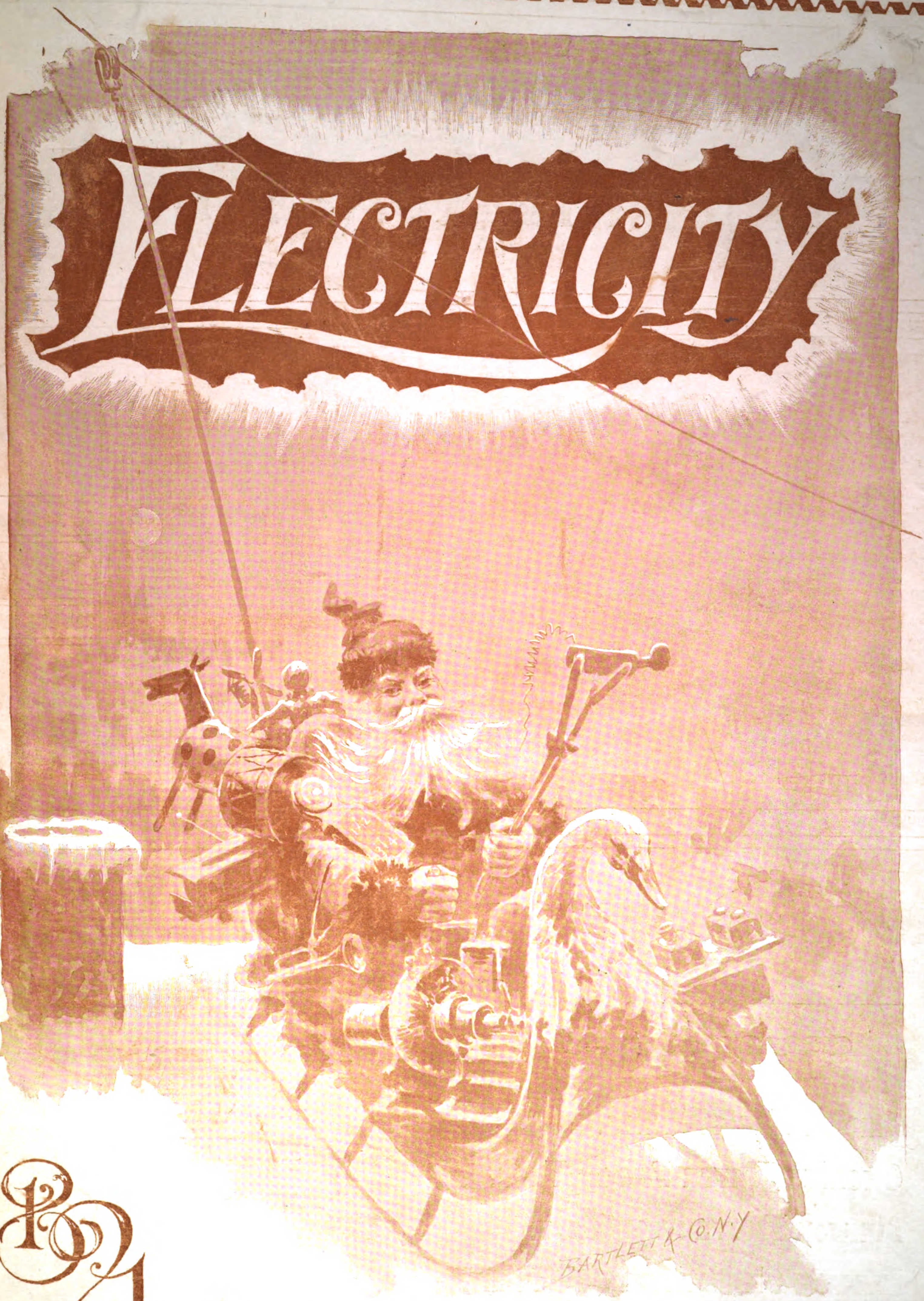
464,246. Electrically Propelled Vehicle. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation. Application filed March 2, 1891.

464,247. Electric Heating Apparatus. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation. Application filed March 9 1891.

461,278. Electrically Propelled Vehicle. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation. Application filed March 23, 1891.

464,347. Magneto Electric Igniter for Combustible Vapor Engines. Leonidas G. Woolley, Grand Rapids, Mich. Application filed Sept. 26.

464.478. Electric Elevator. William Baxter, Jr., Baltimore, Md. Application filed Dec. 8, 1891.



1891 HOLIDAY NUMBER

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ELECTRICITY.

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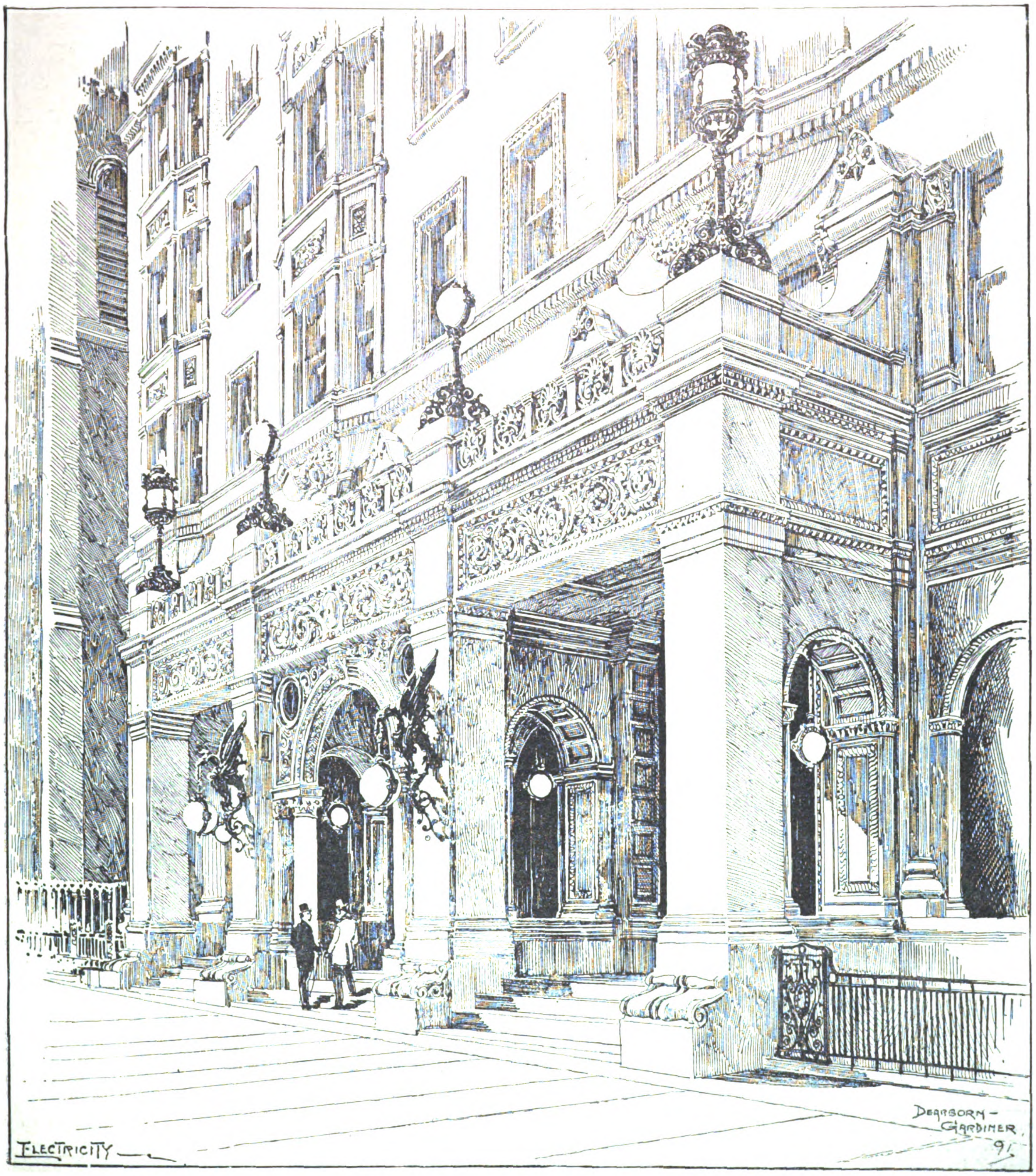


ELECTRICITY IN THE MODERN HOTEL—EXTERIOR FIXTURES AT THE HOLLAND HOUSE. (See page 276.)

ELECTRICITY IN THE MODERN HOTEL.

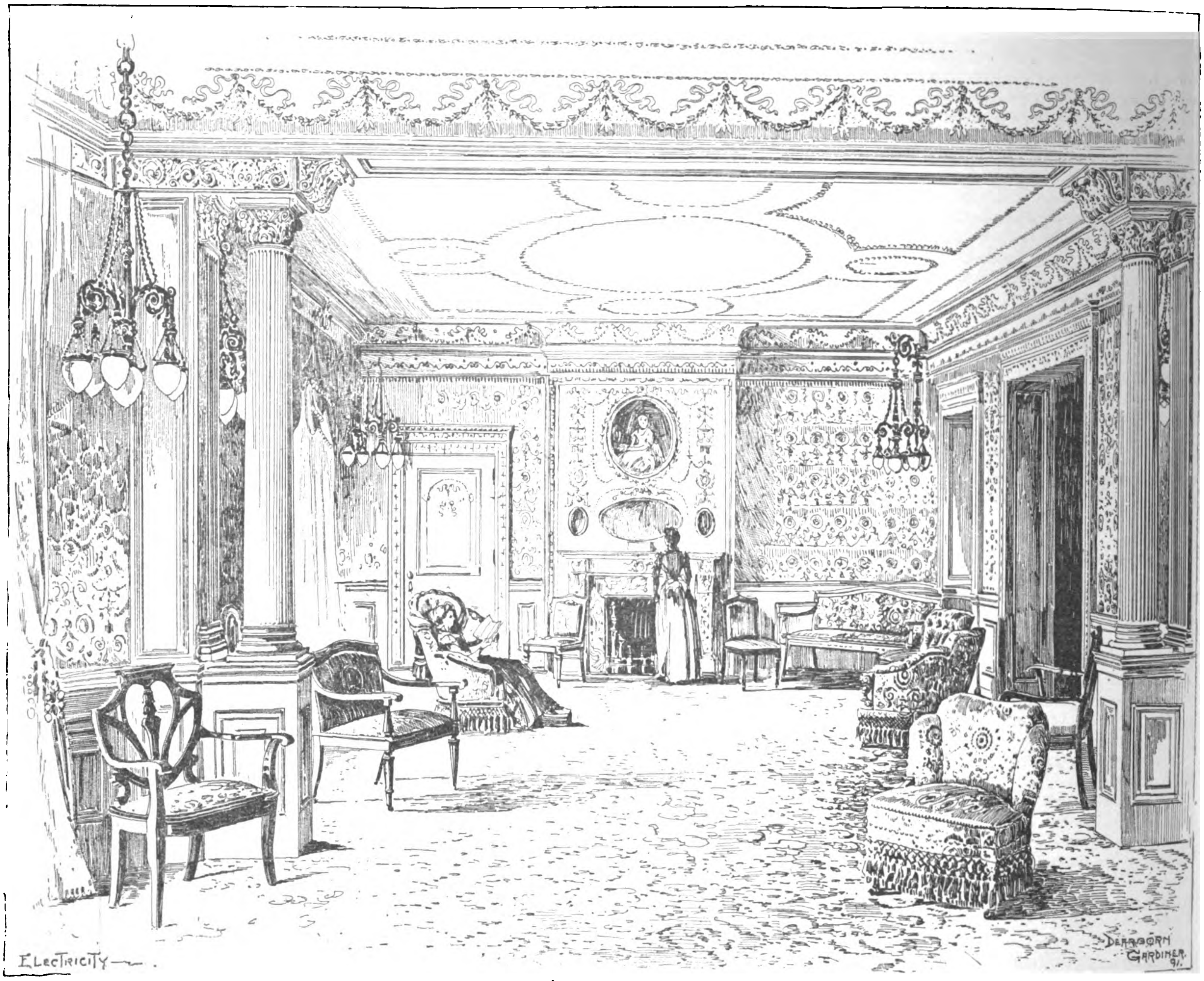
BY GEORGE H. GUY.

We live in an age of luxury. Nowhere is this more markedly apparent than in the construction and embellishment of the hotel of to-day. New York has many magnificent hostelries of recent construction, and it has seemed that in each new building the attempt has been made to outvie all predecessors in concessions to the luxurious tendencies of modern life. Whether this attempt has been always discreetly carried out is questionable. The direction of the latest developments in interior decoration has been towards "barbaric splendor." In some instances taste has been subordinated to vulgar display, and gorgeousness has taken the place of beauty. Happily, however, the latest addition to the rapidly growing list of New York hotels offers to the results of this tendency a grateful contrast. The new Holland House, at the corner of Fifth Avenue and Thirtieth Street, is an embodiment of unique and beautiful effects, and affords a gratifying demonstration that a reaction against the old false ideas of decorative art has set in, and that sound art canons are at last being recognized in this country and have already begun to exercise their refining and salutary influence.

The entrance to the hotel is conceded to be the finest piece of architectural door-work in this city, and some idea of its admirable conception and treatment may be formed from our frontispiece. In the main hall the walls and the carved staircase are of Sienna marble. The floors are in marble mosaic, and the ceiling is decorated in silver. The marble of the stairway is combined most judiciously with Vermont stone, and the handsome effect of the combination is heightened by balustrades of bronze work.

To the right of the hall is the great dining-room, decorated in the Louis Quinze style. The ceiling, in salmon tints and gold, is supported by a row of handsome columns. The panels of tapestry, the mirrors and relievo decorations which are among its principal features, contribute to a general effect the like of which is not to be found in New York. The drawing-room, which is reached by the main staircase, is exquisitely treated in the Adams style. The walls are covered with rose pink satin: the portieres are of a rich and beautiful fabric, embroidered in harmony with the rest of the surroundings, and the floral devices are elaborately carried out in cream and rose. The room is a reproduction of the drawing-room in the historic Holland House, London, which has for so many years been the rendezvous of the most brilliant representatives in Europe of art, literature and society. The number of decorative features throughout the hotel are too numerous even for brief mention, but especially interesting is the Gilt Room, which is also a reproduction from Holland House. Heraldic devices—representing the crests of various members of the Holland family—adorn the panels. The wainscoting of the room has a striking effect. Its wooden relievo columns serve to divide the surface into medallions, bordered with blue and gold. Within the borders silver fleur-de-lis on an azure shield alternate with a golden cross on a shield of red. Even the mantelpieces and the pictures which adorn them in the renowned English original of this room have been reproduced with the greatest care and fidelity.

The general atmosphere of the various apartments in the hotel is artistic and reposeful in a marked degree. It seems, however, as if it devolved on the electric light to bring out in perfect relief the best characteristics of the treatment adopted. The Edison General Electric Company, to whom were entrusted the electric light fittings of the hotel, fulfilled their task in such a way as to establish the fact that a new art has arisen out of the introduction of the electric light, the art of decorative lighting. It is but just to mention in connection with this, the name of Nelson G. Wall, of the Edison Company, who has consistently and ably carried out the work, and from whose pen a recent article in the *Engineering Magazine* on the subject of decorative electricity attracted much attention. The external lighting of the hotel is as simple as it is effective. On the Thirtieth St. side is a row of shining globes suspended from grotesque figures in bronze, and within and over the entrance on Fifth Avenue similar lights are placed. These lights, or as they may be more strictly termed, lanterns, are of the cylinder style. They are made in sections, so that they can easily be opened and closed for cleaning or other purposes. Their light, though brilliant, is toned down and mellowed by an inside glass partially opaque, and thus



Electricity in the Modern Hotel—Drawing Room at the Holland House.

one of the chief objections to the use of masses of electric light is overcome. The fixtures of the globes are suspended from a bracket supported by monumental bronze. This bronze is of specially porous quality, so that it will speedily acquire the antique look which is productive of greater harmony of tone. In the ladies' entrance hall is placed an Italian fallot, an antique lamp with canopied top, which gives a soft and restful light. The contiguous waiting-room is fitted with very fine hammered copper ware, relieved in leaf pattern with polished brass work. The fittings are so arranged that they can be used either for electricity or gas. On the side of the gentlemen's entrance hall runs the screen of the cafe, in which is placed a row of large luminous balls which throw their light both into the hall and the cafe. The cafe is further illuminated by eight 14 inch strawberry-cut globes on oxidized silver fittings. Each globe contains four 16 c. p. lamps. The centre fixture carries an 18-inch globe of similar design, and contains in all 23 lights. In the mirrors which cover the side wall of the cafe, are fixed sun-cut 16-inch globes of the same pattern as those on the north side, and the lighting effect throughout the apartment is one of perfect cheerfulness and comfort.

The office of the hotel is lighted by four large globes, mounted on steel-finished metal work of Italian Renaissance. In order to ensure sufficient light in case of accidental interruption of the supply of current, the centre light is so arranged that it can be utilized for gas, and 65 per cent. of the original light can thus be secured at any time.

The lighting effects in the dining-room are superb. The treatment of the room is cream, relieved with gold, and the finish of the fixtures is mat-gold. On the south wall of the room are fixed 5-light brackets, so arranged as to throw part of their light on the mirrors in the wall, and part on the windows. On the north wall and at each end of the room are 3-light brackets, similarly arranged. The cashier's box, which is in the centre of the south wall, is lighted by a finely-etched lace pattern globe. The columns which support the centre of the room are lighted from Louis Quinze brackets of mat-gold gilt, both on the north and the south side. This room, at night, is one of the most brilliant sights in the city.

The lighting effects in the Drawing-Room are also in perfect taste. They are derived from eight electroliers of mat-gold gilt, suspended from the walls, containing seven lights each. In the foyer, are four torcherres of imitation Damascus steel, each surmounted by a 12-in. soft ground glass globe containing three incandescent lamps with two lights on either side.

An apartment which is sure to be in great request is a cosy Lecture Room, just off the foyer. Its purpose is to serve as a reading-room, or as a refuge when the ordinary haunts of the hotel visitor are too crowded for conversation or privacy. It is lighted by a 10-light electrolier of old English Renaissance, of highly finished hammered copper work.

On the corner of Thirtieth Street and Fifth Avenue is situated one of the bridal suites of apartments. It contains a very fine piece of decorative work, an electrolier of the Louis Quinze order. This is hand-chased, and finished in mat-gold gilt. The flood of light it sheds over the luxurious apartment is softened by a special treatment of the inside of the glass globes with which it is fitted. In this room there is a novel feature, which has much to commend it. In one corner is an odd-looking little closet. Into this closet one door opens from the sleeping room, and another from the hall or corridor. The occupant of the room may place his clothes and shoes here upon retiring, and in the morning will find them brushed and cleaned.

The Gilt Room is lighted by 14 10-light electroliers of heavy cast metal, so arranged that their lower or upper lights can be turned on independently of each other.

One of the prettiest lighting effects in the hotel is shown below. It is obtained by a special treatment of one of the columns in the ladies' entrance, opposite the elevators. These columns are encircled by spirals of old English style of brass and hammered copper. The twining branch is studded with leaves and lily petals, in the centre of each of which burns an incandescent lamp.

The Buffet Bar is lighted by 16 3-light brackets of richly chased copper work, and by three 10-light electroliers of the same character. One of the most important points in the lighting arrangements throughout the hotel is that switches are fixed at points easily accessible to the person in charge of the respective apartments, by which all or any of the lights can be instantly turned on or off. When the bar, for instance, happens to be unfrequented, the bartender turns off all lights not absolutely necessary. A guest comes in, and more lights are instantly raised at the buffet. If the guest takes a seat at the end of the room, a light is turned on for his especial benefit. The economy of this arrangement is evident, and it is expected that in the course of a year the saving from this source will be considerable.

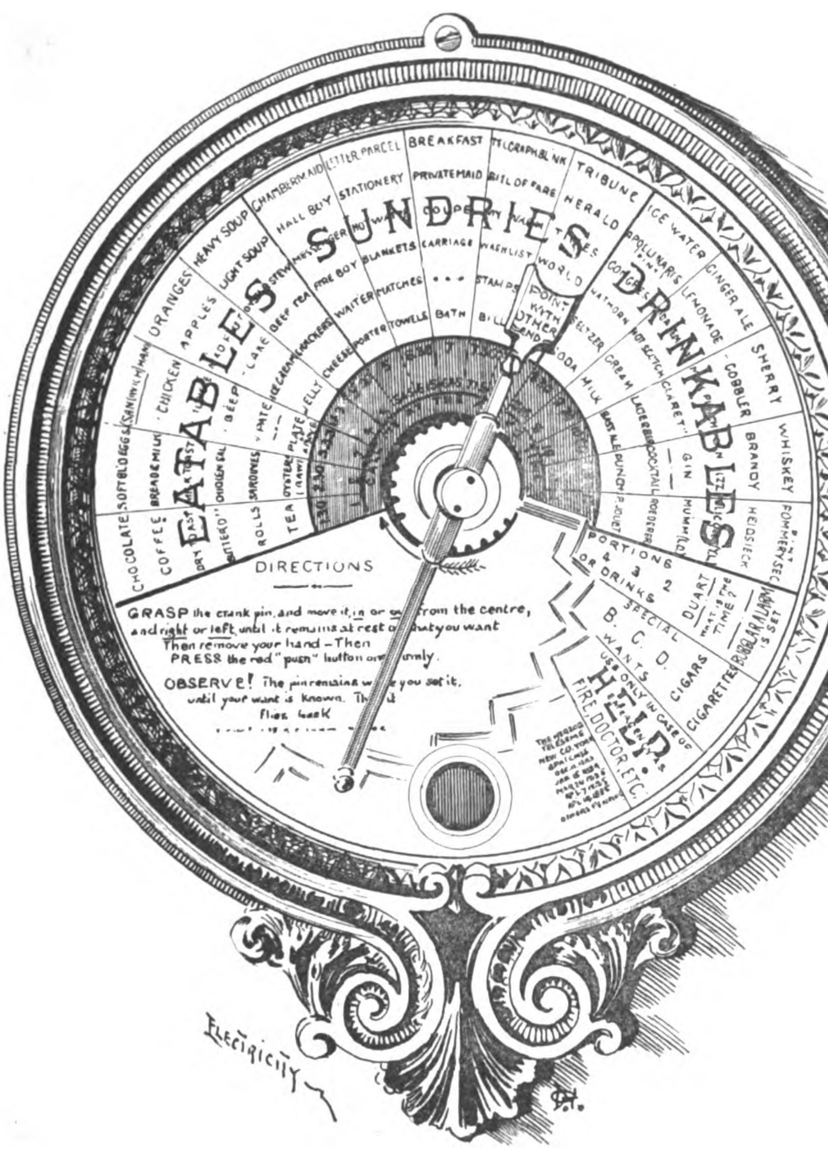
So far as the general arrangements of the hotel are concerned it would seem that nothing has been left unprovided that could in any way contribute to the comfort of the guests. In this regard a very material agency is the teleseme. This electrical device, which is now coming into vogue in large establishments where all manner of calls are constantly being made, is the invention of Dr. J. Benedict Herzog. Each room is supplied with a teleseme dial on which are printed the names of the various articles in daily requisition. The list is a formidable one and can hardly fail to evoke surprise that there are so many things involved in the modern idea of hotel luxury. By moving a crank pin and pressing a button, anything on the face of the dial can be ordered, and the order is instantly transmitted to a corresponding dial in the office, where it receives prompt attention. There is a full complement of breakfast beverages, and every imaginable solid concomitant, from buttered rolls and soft-boiled eggs to chicken salad and oysters. The requirements of luncheon and dinner are also provided for. All kinds of human help, from a chambermaid to a policeman, is available on turning the crank, as are also a carriage, "my wash," a penny stamp, or the principal dailies. It is rather suggestive that fully one-third of the dial is de-

Electricity in the Modern Hotel—Hall Lighting Effect at Holland House.

voted to "drinkables," and of this space one-fifth is occupied with various brands of champagne. Such a list is a dangerous thing to have at one's elbow on a hot summer's day, for it comprises everything from apollinaris to a gin fizz, and includes the insidious sherry cobbler, the seductive cocktail and the patrician "Bass." The completeness of the teleseme arrangement is shown by a special set of figures in the centre of the dial, under which is the injunction "Call me at the above time, but do not disturb me till then." If there is anything more the ordinary hotel guest is likely to call for, the inventor of the teleseme would doubtless be glad to know it.

The electric light plant of the Holland House was put in by the United States Electric Lighting Company. The power is generated from two Porter-Allen automatic cut-off engines, of 100 horse-power and 250 horse-power respectively, driving three United States upright, steel-frame, compound-wound generators, one of 600 ampere capacity, and the other two of 800 ampere capacity each. The small engine drives the smaller generator, and the large engine attends to the wants of the two large machines. The building is wired for 4600 lights, and the output of the generating apparatus in case of emergency would approximate 5500 lights. Grimshaw white core wire has been used entirely for the installation. A feature of the wiring is that all branch wires have been protected by being laid in a separate coat of plaster of Paris, independent of any of the mason work of the building. Plaster of Paris is a good insulating material by itself, and even if the three rubber insulations of the wires of the building should be destroyed from any cause, this method of protection will be effective as long as the building stands. Its actual merit was shown conclusively when the wiring was tested for grounds and short circuits. In the miles of wire inside the building not a single ground was found nor any fault arising from construction. It is also a fact that since the installation was completed (and the lights have been running under full load for more than a week, including the opening reception exercises, in which every light in the building was in use) not a single wire has been removed and no repairs have been necessary.

A feature of the main wiring is that four mains have been carried direct from the engine-room up to the distributing points on each of the floors, giving, first, control from the engine-room of a quarter of any floor independent of the rest; and secondly, affording a provision that only one quarter of the lights can be affected by a temporary disablement of the main wire.



ELECTRICITY IN THE MODERN HOTEL—THE TELESEME.

The lights in each suite of apartments are controlled by a separate switch from these distributing points, so that they can never be used in any room unless they have been first turned on by the person in charge of that floor. All the lights used in the hotel corridors, toilet-rooms, and baths are run on independent circuits, separately controlled from any of the mains serving the guest rooms and other parts of the building. Probably no building in America of similar size has the number of lights installed and ready for use that Holland House has been provided with. Every resource known to the electrical profession has been brought into requisition to raise the efficiency of the electric lighting service to the highest standard and every possible provision against accidents has been made. The consequence is that this plant is one of the most perfect installations of the kind in this country, and can confidently be relied on to meet every demand likely to be made of it.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The architects of each of the Columbian Exposition buildings have been instructed to prepare and present plans for the lighting of their buildings by electricity. It has been decided to place arc lights in all the buildings, except the Woman's and the Administration. These two buildings will be lighted by incandescent lamps only. The system adopted for the distribution of the arc lights is what is known as the street system. The floors will be laid out in aisles, and the aisles will be treated as the streets of a city. Each corner of a block of exhibits will be ornamented with a lamp post of the ordinary style, surmounted by an arc light. The exhibitors will not be restricted to the use of arc lamps for the illumination of their displays, but will be allowed to employ as many incandescent lamps as they desire to pay for.

The exterior illumination will be effected through a liberal distribution of arc lights mounted on high ornamental lamp-posts. The wires for carrying the current to these lamps will be laid in conduits and also strung beneath the elevated railway. The main idea of those in charge of this work is to place the wires carrying current in such a position that it will be impossible to produce an accidental contact from which any serious results might occur.

At a meeting of the sub-committee on ceremonies held last week a resolution was adopted setting apart $25,000 to be spent for fireworks at Jackson Park during the four nights of the dedication ceremonies. The ceremonies committee has had under consideration for some time a proposition from Paul and Eugene Champion, of France, who have invented a system of electric fireworks. The designs are produced by an operator who manipulates a key-board resembling the key-board of a piano. A peculiarity of these electric fireworks is that the display is not affected by the weather and can be produced during a rain-storm as well as in a clear atmosphere.

A compromise between Chief Barrett and Chief Burnham has been effected at last through the committee on electricity. All differences that have heretofore existed have been wiped out, and rules have been prepared by each chief for the government of exhibitors; these will be printed and sent out together. There is an understanding that Chief Burnham will have control of the exhibits up to the time that the exposition opens. After that they will be under the control of Prof. Barrett.

At the last meeting of the Grounds and Building Committee, the subject of intramural transportation was brought up and thoroughly discussed. It was decided that some kind of an elevated railway must be built to carry the passengers from one part of the grounds to another. The road, including the loops, will be about one mile and a half long and will be a double track structure. Bids will be advertised for and the committee will select the system that shall seem best adapted to the work. Although no definite action was taken it could easily be seen that most of the members present were in favor of some system using electricity as a motive power.

Mr. J. Allen Hornsby, secretary of the Department of Electricity, delivered an informal address before the Chicago Society of Operative Electricians at their last meeting. In the course of his remarks he explained the divisions and groups made in the electrical section and said that he had suggested in his report that the same divisions be made in the amateur electrical exhibit. In concluding his address he urged the young men present to exert themselves in getting out a display of their work that will be creditable to themselves and to their Society.

Among the rules and regulations for the guidance of persons intending to make exhibits in the

Department of Transportation that has been sent out by Chief Willard Smith is the following relating to electricity :

Rule 1. Power (electric or compressed air) will be furnished for operating such machinery or appliances as can only properly be shown in that manner. No direct steam power will be furnished, nor will any lines of shafting be erected in the building. Electric or compressed air power must be taken direct, and the exhibitor must furnish his own motor for utilizing the same.

CURRENT ELECTRICAL TOPICS.

Word comes from France of a new storage battery for which greatly increased capacity for given weight is claimed. This battery, manufactured by the Societe Anonyme pour le Travail Electrique des Metaux, has already come into considerable use, it being stated that cells with a total storage capacity for 70,000 lamps are now in use in Paris alone. The plates are of the grid pattern with square holes filled with lead of great porosity. To accomplish this, chloride of lead and chloride of zinc are melted together and moulded to sizes suitable for making up the plates. These are then placed in a bath of hydrochloric acid, which dissolves out the chloride of zinc, leaving the chloride of lead in an extremely porous condition. After drying, these blocks, usually about two inches square, are arranged in a frame, and molten lead poured in, thus forming the grid around the active material instead of (as usual) inserting the active material in the already formed grid. The plates are trimmed up and placed with zinc plates between them in a solution of chloride of zinc, by which the chloride of lead squares are reduced to metallic lead. The plates are then formed in the usual way by the passage of current and are said to have extremely large capacity and to permit of rapid discharge without injury. The ordinary plates are reported to have a capacity of 4.5 ampere hours per pound. Cells of a special type for traction purposes possess a capacity of .8 ampere hours per pound. An installation at the Hotel Continental, of 55 cells has an ordinary output of 600 amperes, and an emergency of 1200 amperes at 110 volts, without noticeable fall in voltage or injury to the plates. These accumulators have been adopted by the French Government, and if all that is claimed for them can be substantiated by continued use, they constitute a distinct advance in storage battery construction.

Mr. Albion T. Snell made the statement before the South Wales Institute a short time ago that he had demonstrated that electricity would pump water or haul coal with an efficiency which was something like double that obtained by compressed air.

SOME UNEXPLAINED ELECTRICAL PHENOMENA. I.

BY NELSON W. PERRY, E.M.

In the following article I venture to publish for the first time the results of some experiments with thin films of non-conducting substances which have engaged my attention at intervals during the past three years and a half. The results obtained are so different from what might have been expected, and seem to follow a law or laws so different from those with which we are familiar, that I am constrained to believe that they are new.

I shall not attempt at present to offer an explanation of the phenomena observed, contenting myself with a circumstantial account of some of the experiments performed and the results obtained. The method of seeking an explanation of the phenomena has been that of exclusion, and by that method the *raisons d'etre* of the phenomena which at first suggested themselves as most plausible seem to be entirely untenable.

Should this paper reach the eye of any one who wishes to repeat the experiments and who may desire more particulars in regard to the manipulation or construction of the apparatus, the writer will be pleased to respond to any inquiries that may suggest themselves.

The instrument usually employed in my experiments was exceedingly simple and consisted of a block of hard wood or ebonite upon which were placed two binding posts by which the instrument proper could be readily placed in an electric circuit. The instrument itself consisted of a tube of hard rubber about two inches long and perforated in the centre. Into either end of this tube was introduced a tightly fitting piece of wire—about No. 18 B. W. G.—so that the interior ends of the two pieces came together just beneath the central perforation in the tube. One of these wires was usually cut off square and the other made conical. Previous to introducing them into the tube these two ends were rubbed on a piece of porcelain or glass containing the powder to be tested, so as to embed a little of it in the metal. The ends were again rubbed on a smooth, clean plate in order to polish the surface, and the wires were then introduced into the tube until, on placing it in a circuit containing a battery and galvanometer, a current was found to pass. By twisting one of the wires a little they were then slightly separated so as to break the circuit.

My first experiments were made with palladium oxide as a "bridge," as I called my non-conducting material. If the distance between the inner ends of the two wires, or perhaps rather their pressure against each other, was just right, the bridge became rapidly conducting if hydrogen gas were caused to impinge upon the junction. The instrument before this treatment was scarcely sensitive to an atmosphere containing less than 50 per cent. of hydrogen, and I naturally assumed that the establishment of the electric circuit was due to the reduction of the oxide of palladium to the metallic state. After allowing the instrument to stand an hour or two I was astonished upon looking at the galvanometer, to find that the circuit which had been established by treatment with hydrogen had again become broken. This I accounted for by the probable formation of a thin film of oxide on the reduced metal, which always forms when palladium is exposed to the atmosphere. On treating the instrument again with gas it was found to be exceedingly sensitive and the galvanometer needle would immediately fly around to its maximum position as soon as the gas came in contact with the instrument, to fall again to zero a few minutes after the instrument had been exposed to the fresh air.

Some of the instruments made failed to return to a state of non-conductivity after being once rendered conducting by gas, but I soon learned from the action of the needle when first sensitizing the instrument whether or not a new tube was to be a good one. If on touching a tube with gas the needle instantaneously or rapidly indicated a high state of conductivity, I knew that the wires were too close together and the instrument would not recover itself. If, however, the treatment with gas had to be continued for several seconds before any conductivity became apparent and if then the needle moved *slowly* from zero to a maximum, the chances were that the tube would be a good one.

I also learned another thing. If, after first sensitizing the tube, it dropped suddenly or rapidly back to a state of non-conductivity on removing the gas, it was not likely to be a sensitive or satisfactory one in after applications, but if the first time it took from half an hour to an hour and a half to return to its normal condition, it was sure to be most satisfactory in its after behavior.

Such a tube having passed satisfactorily through the preliminary stages, which I designated as the process of "forming," would respond to the most minute traces of hydrogen. In an atmosphere containing less than one-tenth of one per cent. it would almost instantly change from a resistance so high that several Leclanche cells in series acting through it would fail to show the slightest current on an ordinary galvanometer, to one so low that the deviation of the position of the needle did not perceptibly differ from that obtained when the instrument was not in circuit, and on exposing the instrument to fresh air it would promptly return to its condition of high resistance again. This could be repeated with the same tube at intervals of a few minutes, sometimes forty or fifty times in succession—the effect of repeating the exposure to gas at short intervals being to render the instrument more sensitive to the gas but less sensitive to ventilation. Or the instrument might be set aside for several days and still remain extremely sensitive to gas, but the final effect of time and use resulted always in the final loss of sensitiveness, which could not be reimparted to the instrument by submitting it again to the forming process ; there seemed to be a kind of fatigue with excessive use from which I was never able to relieve it except in isolated cases.

The instrument was sensitive to all the electro-positive or combustible gases, including hydrogen, illuminating gas, carbonic oxide, artificially prepared marsh gas and ethylene or olefiant gas, and the electro-negative or inert gases, such as carbonic acid and oxygen, when present, had no other effect upon it than that of diluents. So far as I was able to judge, a given percentage of hydrogen gas in an atmosphere of carbonic acid gas was quite as effective as when the diluent was atmospheric air or oxygen.

The most natural interpretation of the phenomenon was that it was due either to occlusion or to the reduction of a superficial film of oxide, or to both, but subsequent experiments disproved these hypotheses. I substituted for the palladium oxide successively gold, silver, zinc, tin and iron in extremely fine states of subdivision. In this condition they are all practically non-conducting unless subjected to considerable pressure. The adjustment was always made, however, so that the bridge was non-conducting. With all these metals the phenomena were reproduced in kind, but these substances were less sensitive than the palladium oxide and fatigue came sooner. Since some of these metals, notably zinc and iron dust, also exhibit the property of occlusion of gases, the agency of that property was not yet disproved.

The next series of experiments was with metallic oxides other than that of palladium and while many were tried, absolute failure resulted with none. One of the experiments consisted in simply heating the ends of the two copper wires until they were both covered with a thin film of their own oxide. With this some good results were obtained, but fatigue came soon. Since this series of experiments was with oxides there was still a suspicion that the action was due to reduction, although many of the oxides experimented with are not known to be reduced by gases at ordinary temperatures, so the next series of tests was with substances known to be inert at all temperatures with the gases employed.

NEW PULLMAN STREET CARS.

In an article on the Pullman centre vestibule street car in our last issue, the following statement occurred : "While the car is, if anything, a shade too long to take some of the very sharp curves in Boston with ease, it is likely that quite a number will be ordered to conform to the extreme difficulties on our street track."

We are informed by the Pullman Company, since the article was published, that a number of extra cars have been ordered, but instead of being shorter they have been ordered three feet longer than the experimental car that has been in use in Boston.

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Honor to Whom Honor is Due. A writer in this issue of ELECTRICITY, who modestly prefers to remain unknown, enters a humorous plea for the recognition of the services of the early workers in the electric lighting industry. The inventors, he thinks, have had their full share of the honors and riches that have been bestowed on the early pioneers in electrical engineering, and which they have richly deserved. But the rank and file, who installed the crude and ricketty machines of a few years ago, ran the wires, hung the lamps and made the whole thing work in spite of apparently insuperable difficulties that taxed their resources to the very utmost at nearly every step—these, who made electric lighting a success almost in spite of itself—where are their honors? Most assuredly they bore the brunt of the battle; they were the advance guard who forced their way into the enemy's country and overcame that most deadly obstacle to a young industry—popular prejudice and opposition to new ideas. All this they did while the inventors and constructors fussed in their laboratories and workshops designing and making machines that would not run half an hour without burning out and lamps that would light up for ten minutes and then relapse into gloom, like arsenals that turn out collapsible bayonets, guns that will not fire and cartridges that refuse to go off; while presidents and managers fumed and fretted in their offices like cabinet ministers directing the battle from a safe place and compiling impossible dispatches in ignorance of the conditions at the seat of war. The inventors and the constructors, the presidents and the managers have reaped the *kudos* and the cash, while the fighters at the front, who did so much to help them out of their early difficulties, have remained, to a great extent, in the obscurity in which in this unjust world those who fight and work are left fighting and working to the end of their days. Many of them will find interesting reading in the account of some of their struggles given in these pages.

* * *

Artistic Electric Lighting. It will be remembered that in Mr. Hornsby's report of his visit to the Frankfort Electrical Exposition, which was published in full in ELECTRICITY for Nov. 11, he stated that in his opinion European electrical engineers excelled those of this country in many branches of the industry, most notably, perhaps, in decorative electric lighting effects. It is most natural that in Europe where art centres abound on every hand and where artistic feeling is far more generally disseminated than it is on this side of the Atlantic, artistic treatment should be applied whenever it is possible. The electric light certainly lends itself with remarkable facility to the attainment of artistic effects quite impossible with gas or with any other illuminant. The illustrations published in past numbers of ELECTRICITY have frequently borne witness to the beautiful work in electric light fixtures produced by European manufacturers and they have been deservedly admired on all sides. This week we present some illustrations of the strikingly handsome fixtures used in the electric light installation of the new Holland House. These fixtures are all of American manufacture and we think they will compare favorably with similar work in Europe. The illustrations necessarily give but a limited idea of the wonderful decorative effects produced by the aid of the electric light in the various departments of the new hotel, such effects are not to be conveyed in black and white, they must be seen to be thoroughly appreciated. Mr. Guy's admirable description of the installation and its wealth of artistic features shows very clearly that decorative electric lighting has attained to a high pitch of excellence in America. Almost every possible variety of fixture has been used in the installation, iron, bronze, copper, silvered and gilt metal, and in all styles of decoration. The electric lighting of such an establishment forms a liberal exhibition of electrical high art.

* * *

The World's Fair Abroad. Exhibitions are a fruitful topic of discussion just now, and the World's Fair, with the glowing prospects of a magnificent success in all departments, naturally overshadows other ventures of the kind. An electrical exhibition is to be held this winter in London, and those who are promoting it have had to exert their most strenuous efforts to secure the support of the electrical manufacturers. This enterprise is spoken of as a "national" exhibition and in commenting on the subject the London *Electrician*, whose comments on exhibitions in general are at all times tinged with bitterness, remarks that "Since no Protectionist country can with any sense of decency hold an 'International' exhibition, the idea of *national* exhibitions is well worthy of consideration." This is a little wide of the mark and indicates a rather narrow-minded view of the subject. It is to be presumed that an international exhibition of any scope will attract international attendance of visitors as well as international exhibitors and is therefore more likely to be beneficial to those who take part in it than a merely national show. The London *Electrical Review*, we are glad to observe, strives to give its readers a more encouraging view of international exhibitions in general and of the World's Fair in particular. It points out that in 1893 Chicago "will be visited by people from all parts of the world, and by many who are keenly alive to what they see around them. It behooves English manufacturers, therefore, to show that they are second to none in the quality and variety of their products, and this they must do by displaying their wares with a lavish and unsparing hand; for although they may not at the time cover their expenses, the outlay will be well repaid in the end, if they can clearly show, as they certainly can, that their workshops can execute work unequalled in quality and finish by any competitors. * * * It is to be sincerely hoped, therefore, that those who are working hard to make the English section of the exhibition a success will receive the very fullest support and encouragement, and not the least as regards the industry which the *Electrical Review* represents." This is the right sort of feeling to inculcate and is quite in accord with what been said in these columns regarding a representative exhibit from Great Britain in the electrical section of the World's Fair. Several of the more important firms have already signified their intentions of exhibiting on a large scale and they will undoubtedly be spurred on by the ambitious plans of Messrs. Siemens & Halske, mention of which is made in another column of this issue. It is quite obvious even at this early date that the electrical industries of Europe will be very well represented at the World's Fair.

* * *

An Opportunity for Comparison. Readers of electrical journals have become quite familiar with dissertations by Americans on the miserably backward state of electrical engineering in Europe and by Englishmen on the atrociously bad construction and generally loose work which they have observed on flying trips through "the States."

These observations of peregrinating electrical engineers are seldom of much value, being generally characterized by loose statements and hasty conclusions, all external conditions being as a rule entirely ignored. The Electricity Building of the World's Fair, however, will place American and European electrical engineering side by side. As we point out above, there can no longer be any doubt of a strong representation of the products of European electrical manufacturers. It is also practically settled that European firms will be allowed to take part in the general electric service of the exposition and will do their share of supplying current for light, power and other purposes. Thus the ground is prepared for a very comprehensive display of the achievements of electrical progress in the New World and the Old. Not since electrical engineering became a recognized scientific profession has an opportunity been presented

for general comparison and it is not likely that the opportunity will repeat itself at least for another ten years or so. American electricians will undoubtedly be put on their mettle by the direct competition they will make with European firms, and these on their part will be urged to make every possible effort by the fact that they are entering the lists against the manufacturers of a country that is renowned the world over for its enterprise in the application of electricity to useful work. The result bids fair to be a prodigious electrical display before which other features of the exposition will pale into comparative insignificance.

ELECTRICITY'S CHRISTMAS SOUVENIR

The joyful season now approaching appeals to electrical men just as strongly as it does to any other class or profession, perhaps even more so because it is well known that electricians are almost invariably blessed with domestic instincts to a marked degree. It is eminently fitting therefore that ELECTRICITY, the only journal that links the electrical profession with the general public, should celebrate the holiday season by the issuance of a Christmas souvenir. The beautiful design which ornaments the extra cover of this week's issue is a pleasant flight of fancy on part of the artist, who has shown our old and esteemed friend Santa Claus very much "up to date." Henceforth ELECTRICITY will count with many young friends in electrical households. The souvenir cover has been availed of by several of our well-known friends to make seasonable announcements which will appeal to the heads of those households. The Ward Arc Lamp, that shining light of the Electrical Construction and Supply Company tells its tale by means of what might be called an artistic poem without words. The staple article of the Okonite Company, its resistance raised to an almost bewildering number of megohms by the frigid temperature which ought to reign at this time of year, is described as those who know it know that it deserves to be described. The Edison electric light sheds its beneficent rays over the globe, typifying "peace on earth and good will towards men." Messrs. Bartlett & Co. have excelled themselves in their work on this beautiful cover.

SIEMENS & HALSKE'S EXHIBIT AT THE WORLD'S FAIR.

Messrs. Siemens & Halske, the well-known German firm of electrical engineers and manufacturers, propose to outdo all their competitors in the extent of their exhibit at the World's Fair. Herr Carl Vogel, the managing director of Siemens & Halske, arrived in Chicago last week, having come from Berlin to confer with Director-General Davis and Chief Barrett, of the Department of Electricity, relative to the display which his firm wishes to make at the Exposition. Herr Vogel came to Chicago in pursuance to an agreement between him and Mr. Hornsby, who recently visited Europe in in the interest of the Department of Electricity.

Herr Vogel promised to spend 900,000 marks, or approximately $225,000. He asked for a special building, 60x60 feet, in which to place the display. He said that the company would be willing to expend $65,000 on the structure. The Committee on Electricity formally decided on Monday last that space could not be granted outside the regular buildings. Meanwhile the Department of Electricity has offered to Messrs. Siemens & Halske, 20,000 square feet in the Electricity Building and 10,000 square feet in the power house. With this allotment it is thought Herr Vogel will eventually be satisfied.

Thus far no electrical firm in America has offered to make an equal expenditure of money on an exhibit, and the Exposition management is strongly in favor of giving Siemens & Halske all the space they desire in the buildings. The firm promises to bring to Chicago 340 tons of machinery, the largest piece weighing 4500 pounds.

Herr Vogel, however, is desirous of knowing something about the protection which will be afforded the patents owned by his company. In a general way his queries on this subject have been answered, but he has brought up a new point of interest to all intending foreign exhibitors who are inventors or owners of patents. The American patent laws, it appears, protect the man who secures a patent in the use as well as the manufacturer and sale of the device which he has invented. Herr Vogel wants to know whether he can use as part of his exhibit devices which are patented in Germany and which may be also patented in America. Solicitor-General Butterworth has not as yet given a satisfactory answer to the questions involved.

NEGLECTED PIONEERS.

It is related of Sir Walter Scott that while the authorship of the Waverley Novels was still uncertain he was taxed with being the author by an old lady who had related to him some of the anecdotes which he used in those works. To his evasive answers she made only one reply,—"Hoots, laddie, do ye think I dinna ken my ain groats in other folks kale?" Similarly I may say if any one recognizes their groats in my kale, all I ask is that they do not give me away.

All kinds of compliments and honors have been paid to the early pioneers in the *invention* of the electric light, and as years go by these honors are more justly and more freely distributed. So far, however, no prophet has arisen to call attention to the honors due to the rank and file who *introduced* the electric light, and to those who, all unknown, helped many a weak installation through and got payments for plants for which the managers of the companies would not collect.

While I have not had very much of this experience myself, I have had some and have met those who have had more. With the present accumulation of knowledge and experience in handling the mysterious "juice," the necessity is not so great for that readiness of resource which always marks the true inventor, yet I think that the recital of a few of the deeds of these heroes unknown to glory may not be without interest.

Away back at the time when an electric lamp was still a thing of mystery and a big card in advertising, a certain magnate in a southern city, who was about to entertain his friends at a large ball, decided that seven or eight arc lamps in his house would effectively add to the splendor of the scene. He interviewed the manager of the local company, who made the condition that he should secure the right-of-way from the station to his house (a distance of about one mile and three-quarters) on the poles of a certain telegraph company. This was successfully negotiated, and the boss lineman was put in charge of the installation with the general instructions that those lights had to be going by 6 o'clock in the evening, *Deo volente*, and by 7 o'clock whether or no.

Like a good general, Dennis began by installing his lamps; he had them all properly hung, wired and trimmed, and left the ends of the circuit outside one of the windows so that his men would not be in the way or find others in their way as the time for the starting drew near. He then proceeded to run the wire from the station to the house, and at half-past five had run one line complete and was within half a mile with the other when his wire gave out. Sending to the station for another reel he was confronted with the fact that the company had absolutely none in its storeroom. Even all the scrap had been sold but a week before, leaving not a hundred yards of wire available. The telephone was in immediate requisition and every one in town likely to have copper wire was called up, among others the writer, then engaged in installing a large isolated plant, but who was himself in the same fix. The town was suffering from a wire famine from which there was no relief. It must be remembered that copper wire of any kind was not then a commodity so easily obtained as it is now.

Dennis found himself in trouble, and when 6.30 arrived and there was no copper wire he thought that his name was truly "Dennis" if he could not get out of the hole somehow, but what with the magnate howling for the lights at one end of the line, and the superintendent at the other end howling for the closing of the circuit, he was almost in despair. It was dusk by this time, and with a brilliant inspiration and that reckless disregard of other people's rights which forms such a pleasing feature in the average lineman's character, Dennis calmly proceeded to cut six or eight of the telegraph wires at the point where his copper had given out; these he bunched together on one end of his line, then he hustled up to the magnate's house, and cutting the same six or eight wires proceeded to connect them up with what little scrap he had to the ends of the house-line. He then cheerfully telephoned to the station to "GO AHEAD." The lights came up in great shape and every one was delighted.

When the ball was over at 4 o'clock in the morning, Dennis, with one trusty henchman sworn to secrecy, proceeded hastily to splice up the wires which had been cut. Half an hour later, with the calmness born of conscious rectitude and duty done, he watched the unhappy linemen of the telegraph company wandering up the street with their eyes turned heavenward to discover the trouble on the "Associated Press" and several "local" lines.

A well known superintendent of the United States, whose name would be instantly recognized were I to give it, when first starting in to convince a stubborn municipality that they should pay full price for half the lights half the time contracted for, found himself one night shortly before the starting up hour, with a very much demoralized collection of apparatus on his hands. First there was a T.-H. 25-lighter with blower wings burnt out; second, a Brush 30-lighter with one cross connection in the armature and another in the field-magnet, then, an Excelsior dynamo with the same trouble; and lastly, there was a Brush 60-lighter which had no armature in it.

The first defect he started in to remedy was the blower upon the T.-H. machine, and he incidentally discovered that the mahogany back of the state chair belonging to the president of the company furnished excellent material for this purpose. This having been arranged and his lineman reporting that all the circuits rang out clear and without grounds, he proceeded to connect the fields of the Brush 30-lighter in circuit with one of his outside lines, and put this on the T.-H. machine, while the armature of the Brush 30-lighter was connected through the fields of the Excelsior dynamo, and so out to his line; then the Excelsior armature was run through the fields of the Brush 40-lighter and out to line. In this way the various contacts were insulated from one another, and the lights started up on time and ran through the night. They were run in this way for several nights until the return of the Brush 60-light armature enabled him to shut down long enough to unwind armatures and field-magnets.

He stated that the only pleasant feature about the whole business was having a good excuse for getting even with the president by sawing up his beautiful chair.

A gentleman who has held a high position in the National Electric Light Association was connected

with the Thomson-Houston Company, when that company, instead of the magnificent system which it now offers, had nothing but their old drop and lift lamp. He was sent out on more than one occasion with a number of these lamps and a dynamo to exhibit and has been heard to describe the various methods used to convince the customer what a perfectly steady light they had. Any lamps which were hung up throughout a building could have their imperfections blamed on hasty installation and defective construction or vibration of the building, whether this last was a barn or a bank. The whole object therefore was to keep burning steadily the exhibition lights, which would be burned on a rack close by the dynamo. This was done by keeping one eye and the whole mouth on the customer, and the other eye and one hand upon the lamps.

Careful watching would show when a lamp was getting ready to flame up and consequently "drop its feed," and about that time the guileless expert would remark, "You observe these lamps are just as easily controlled as a gas jet," and would switch the lamp off. Down would come the rod, the switch would be thrown on again and the lamp would immediately start up to burn for another ten or fifteen minutes before a repetition of the dose would be necessary. Fifteen minutes was more than enough to fill any single lis ener so full of information that he had to retreat to recover from it, and not more than half a dozen phrases were necessary to cover any lamps which might fall due within this time. Some of the favorite ones were, "You will observe that there is no danger whatever in handling these lamps;" "It is important that the lamps should be kept steady. as you will see how I make this one jump by striking it;" "It is a good rule to keep one hand behind your back while you use the other to switch off the lamp, thus," etc.

Is not something due to these hardy pioneers for the fearful risks they took in thus imperilling their hereafter by such deceitful ways?

NEW COURSE IN ELECTRICAL ENGINEERING AT COLUMBIA COLLEGE.

An undergraduate course of four years in Electrical Engineering has been established in the School of Mines, Columbia College, in addition to the present two-year post-graduate course which has been in successful operation for several years. Thus there will be two complete courses in Electrical Engineering in New York City. The latter course is for graduates of scientific schools and colleges, and is entirely devoted to electrical engineering proper, the students having previously made the necessary preparatory studies in mathematics, physics, chemistry, mechanics, drawing, etc. This course is found to give the most excellent results by reason of the maturer years and better training of post-graduate students. In addition to such graduate students there are, of course, many younger men who desire to enter a course of electrical engineering immediately on leaving school without going through a previous collegiate course.

A new four-year course has therefore been established similar in plan to the well-known courses in mining, engineering, civil engineering, chemistry, architecture, etc., at the School of Mines, with the same requirements for admission, which are equal to the regular entrance examinations at first-class scientific schools. The first two years of the new course will cover the preparatory work in mathematics, physics, chemistry, mechanics, drawing, etc., required for admission to the post-graduate courses. The last two years will be devoted to a thorough course in electrical engineering proper, and will be equivalent to the present post-graduate course, hence there will be no lowering of standard. As a preparation for the study of electrical engineering the first two years of this course are equivalent to four years in any course other than electrical engineering, much time being saved without sacrificing any electrical engineering subjects.

The instruction of electrical engineering will be conducted as heretofore by Prof. Crocker and Dr. Pupin. The mathematics, physics, etc., will be taught by the professors of those subjects.

The degree given to those who satisfactorily complete the course will be that of electrical engineer. The new course will begin October, 1892. Examinations for entrance will be held in June and September.

The one-year partial, or special course will be abolished next year to make room for the students in the regular course.

CHANGING TELEPHONE NUMBERS IN CHICAGO.

The Chicago Telephone Company have decided to change their system of numbering telephones. This action was brought about by the trouble experienced by both the subscribers and the telephone operators in understanding the numbers called for and the connection desired. Another and more important reason for the change is the fact that the call for telephone service from those desiring to become subscribers has outgrown the limit of numbers assigned to each district. The present system used in arranging the telephone numbers is to divide the districts according to the natural boundaries, into North, South and West sides, a definite set of numbers being assigned to each district.

The system that the company propose to adopt is similar to the one in vogue in New York. The districts will remain the same as at present but instead of using a number containing four or more figures a word indicating the district will be placed before the last three figures of the number now in use. For example, a subscriber desiring a number on the West side, instead of asking for 7359, will call "West 359." A number in the stock yards district will have the prefix "Yards" attached to it. All telephones connected to the Canalport Avenue station will have the prefix "Canal." The change will be made in all the districts except that portion of the South side known as the business district, which must necessarily have figures of four places. The change will not be made until about the 15th of next February, when the new directory of the Chicago Telephone Co. will be issued.

DETECTION OF ELECTRO-MAGNETIC DISTURBANCE AT GREAT DISTANCES.

Mr. G. M. Minchin published a paper in the *Philosophical Magazine* for last March, giving an account of his work in photo-electricity and a description of the cells employed to which he has given the name of "impulsion" cells. The positive plate upon which the E. M. F. is generated by exposure to light is a specially prepared sheet of tin foil and the liquid employed is methyl alcohol. One of the peculiarities discovered in this cell was that the most minute mechanical disturbance given to the base orsupport of the cell would make it insensitive to light if it was previously sensitive, or sensitive if it was insensitive. He also stated that when such a cell is in the insensitive condition it can be rendered sensitive by the inductive action of the sparks of a frictional machine or of an induction coil, and that the induction coil was found to be effective in altering the cell while enclosed in a dark box at a distance as great as 81 feet.

In a later series of experiments Mr. Minchin found that if the coil were removed to a distance of 130 feet from the cell, the sparks were sufficient to make the cell sensitive to light if it had previously been made insensitive in any way. Writing to the London *Electrician* of November 27th, he says that by means of a recent experiment he has been enabled not only to *see* but to *hear* the effect produced on this cell by the electro-magnetic action of the induction coil.

The arrangement is as follows: One terminal of a Clifton-Thomson electrometer is connected to one electrode of the cell and also to the earth. The other terminal of the electrometer is connected with the other electrode of the cell, which is also connected through a telephone receiver to one pole of a condenser—the other pole of which is grounded. "Now if, either by talking to the cell or by touching its support with a feather, we make it insensitive to light, and then allow it to charge the condenser for a few seconds, on putting the telephone to the ear, and causing the spark to pass between the terminals of the induction coil at a distance, we hear a sharp click in the telephone at the instant at which the state of the cell is altered by the electro magnetic induction." These effects are produced notwithstanding the presence of an intervening wall between the induction coil and the cell, provided only that the wall or screen be not of metal. Stone or brick, or other non-conductors are perfectly transparent to these electro-magnetic waves although impervious to light rays.

Mr. Minchin finds that the capacity of the condenser has some effect on the results—that one of small capacity will not answer, but that there is not much difference in the sounds produced by a condenser of .05 and one of 1 microfarad. "Also, with some impulsion cells, although the electrometer enables us to *see* that they have been changed by the sparks, the sounds are so feeble that they can scarcely be recognized in the telephone—showing probably that the alteration of their molecular state is comparatively slow. With other cells the clicks are loud enough."

This bringing within the grasp of our senses of the longer electro-magnetic waves, is directly in line with a suggestion that appeared in the last number of ELECTRICITY, in which we said: "In the fact that walls and fogs are impervious to light rays while they form no barrier to electric waves of a foot or two in length, we have a suggestion of the possibility of transmitting signals at sea or elsewhere through fogs or walls by means of electrical waves to which they are perfectly transparent. The possibilities in this direction are very apparent, and the actual accomplishment only awaits a method of transformation from the longer to the shorter wave length."

Dr. Werner von Siemens has performed a series of elaborate experiments upon the sterilization of water through the action of ozone generated by electricity in air passed through tubes. The ozone thus generated is passed through the water to be sterilized and acts destructively upon the lower forms of both animal and vegetable life as well as upon organic substances generally. This sterilized water has been found very useful in the manufacture of beer, as it prevents the growth of disease ferments in the wort during the process of fermentation.

The pilots of Havre complain of the lack of penetrating quality observed in the electric lights in the harbor. They say that during foggy weather the brilliancy of the electric light is much more reduced than that of oil lamps—so much so that in very foggy weather while the light from oil lamps was plainly visible it was impossible to discern that of the electric light. The London *Electrical Review* states that the electric lights in some of the lighthouses, especially those near the entrance to the Thames, sometimes become invisible, while at the same time the lights from the light ships and lighthouses burning oil and even the gas lamps in towns on the neighboring coast are plainly visible.

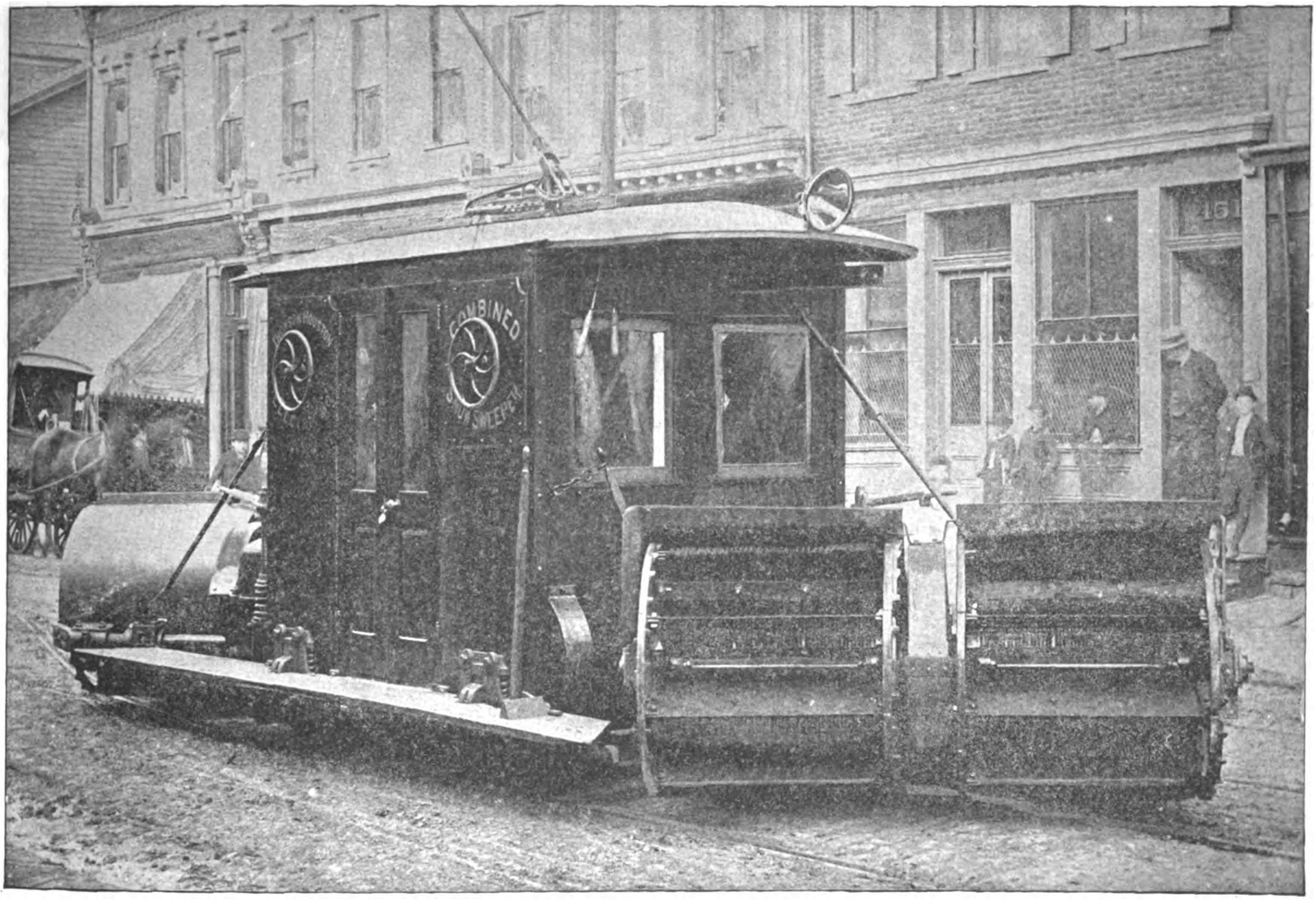
A COMBINED SNOW PLOW AND SWEEPER.

After more than a year's thorough study and investigation undertaken by a committee of experts in their employ, The Thomson-Houston Electric Co. have succeeded in planning and building a type of combined snow sweeper which is likely to become the standard for several years to come and of which quite a number have already been built, and are now doing most satisfactory work on street railways in different cities of the west and northwest.

The machine consists of a heavy steel beam frame, bolted together with cast steel connecting angles and supported on springs in such a manner that it hangs below the axle, mounted on thirty-six inch four hundred pound wheels. The ends of this frame are built at an angle of forty-five degrees, and on each of the angle beams are bolted steel plate blades constituting the paddles. To these paddles are bolted brushes made of flat, spring-tempered steel wire, set edgewise so that the wire projects one inch beyond the paddles or on the same line as the periphery of the wheels. The "flyer" is raised and lowered by a screw attached to the cradle. This screw is worked by a ratchet hand lever, the total vertical adjustment being about six inches.

A drag ice digger is also provided, consisting of of a cast-iron shoe grooved to fit the rail, to which it is held down by a spring immediately in front of each wheel. These diggers can be raised or lowered at will and are used to remove from the rail any snow or ice left by the "flyer," leaving an absolutely clean rail, and consequently perfect contact for the wheels. A cab is provided as shelter for the men and to protect the wires and electrical apparatus, it also forms a support for the trolley stand and pole. Shears or wing scrapers are portable wire guarded lamp with attaching plug and 25 feet of flexible cable is also provided.

In dealing with a light fall of snow the "flyer" is revolved at its normal speed and the truck is driven on the multiple connection at full car speed, leaving a perfectly clean road-bed and rail, or leaving a clean rail with several inches of snow on the road-bed for the easy hauling of sleighs. Where deep and heavy snow, ice, or steep grades are met, the truck is propelled with increased power, but less speed, on the series connection, the speed of the "flyer," however, remaining constant.' As the "flyer" has eight blades and makes one hundred and fifty revolutions per minute, there are eight times one hundred and fifty or twelve hundred blows struck each minute; and as these 1200 blows can be struck within a linear distance of ten feet it can be readily understood what tremendous execution the machine is capable of doing. The



THE THOMSON-HOUSTON SNOW PLOW AND SWEEPER.

two steel bearing stands, in the bearings of which rests a steel rocker shaft. On one side of the rocker shaft are keyed three steel arms for supporting the "flyer," while on the other side is keyed a cast-iron cradle in which the motor driving the "flyer" rests.

The "flyer" itself is one of the most important features of the machine. It can be likened to the paddle of a stern wheel steam-boat, set at an angle of forty-five degrees with the boat instead of square across. In the sweeper, the paddle is represented by the "flyer" on that end of the machine which is advancing, the other "flyer" being raised from the ground and not in use. The construction of the "flyer" is somewhat as follows: Four steel spider castings, each with eight radial arms, are keyed to the "flyer" shaft. To these radial arms are bolted other steel castings of such shape that the whole forms two pairs of wheels forty-four inches in diameter on one axle. Between the spokes of each pair of wheels are bolted likewise provided, extending on one side for the purpose of gathering the snow from between the tracks into the "flyer," so that it may be thrown off, and on the other side to level the snow which accumulates beside the track in order that it may not fall or be pushed back on the rail.

The electrical equipment consists of four railway motors, preferably of a water-proof type. Two of these motors are of standard speed and are connected to the axles in the usual manner. The other two differ from the axle motors only in the fact that their armatures and fields are wound for 1200 revolutions per minute normal speed under load, instead of 620 revolutions, the speed of the axle motors. The rheostats are fastened to the sides of the cab and are operated by hand wheels on the outside, as shown. The arrangement for lighting the machine consists of two five lamp light circuits, each circuit consisting of a head light on the hood, one lamp outside the cab under the hood and three lamps inside the cab. A total weight of the sweeper is 25,000 pounds, or about the same as a sixteen-foot car with eighty or ninety passengers aboard. This type is being built in three different sizes to meet the requirements of the various gauges of railway track.

ELECTRIC CARS IN CHICAGO.

It has been reported that Mr. C. T. Yerkes, president of the West Chicago Street Railway Co., is making arrangements to construct a section of the Siemens & Halske electric railway on some of the West Side street car tracks, as an experiment with that system. While in Europe this summer Mr. Yerkes saw a number of these railways in operation and was very favorably impressed by them. It is expected that the West Twelfth Street line will be the one selected to experiment with. On Mr. Yerkes' return from New York the plans will be completed and work will begin immediately.

A SELF-VENTILATING DYNAMO.

The theory that the armature of a motor or dynamo can be so constructed that it will not develop more than a certain degree of heat above the ordinary atmospheric temperature is probably correct. Practical experience and numerous tests have proved, however, that it is neither economical from a commercial standpoint nor practical from a mechanical standpoint to try to reduce the heating effect of an armature below a certain number of degrees. The number depends on the size and dimensions, and on the work required of the armature. The heating of the armature in either a dynamo or a motor therefore is almost an inherent or necessary evil.

To obviate this defect, Mr. Martin C. Burt, of Chicago, has invented and patented a method of forcing a blast of cold air through the armature coils, and in this manner both the core and coils are kept constantly cool regardless of the load placed on the machine.

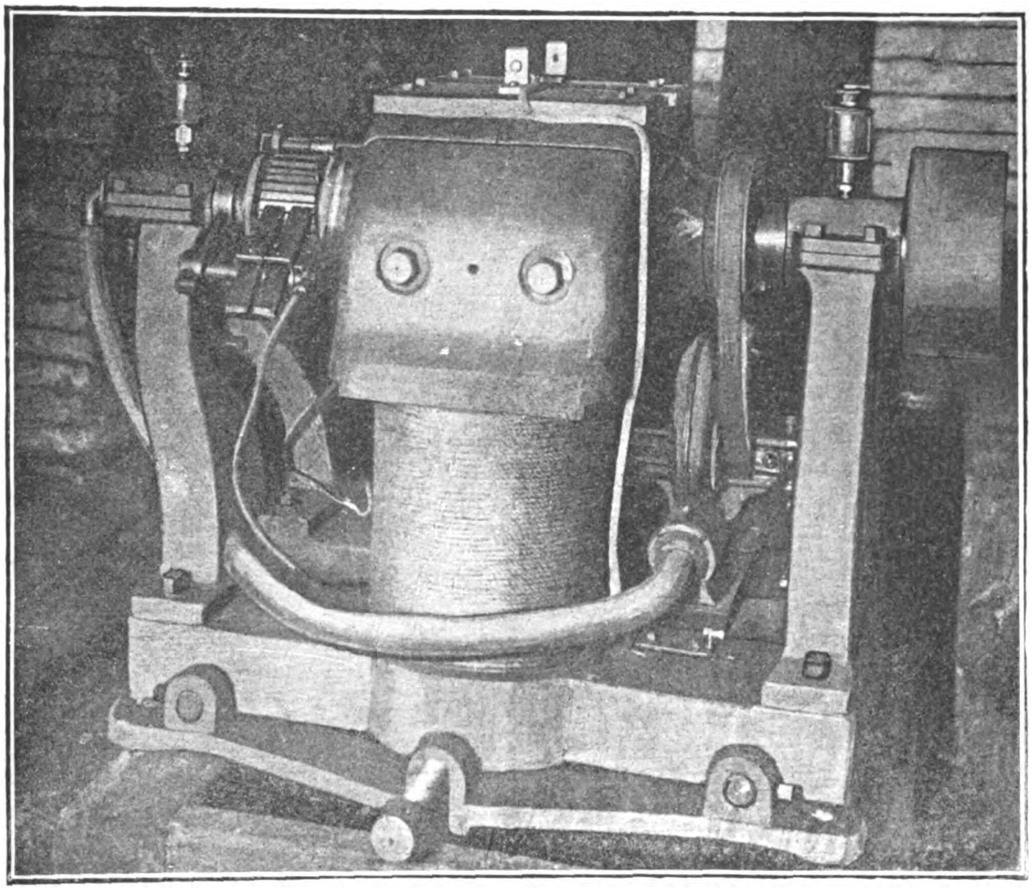
The manner in which this is accomplished can be seen from the illustration, which is a reproduction from a photograph of the first machine built to test the practical operation of a dynamo of this design. The dynamo is of the ordinary bi-polar type with a drum armature. Upon the base of the dynamo, on the pulley side, is the blower, belted directly to the shaft of the dynamo. The outlet of the blower is connected to the commutator end of the armature shaft by means of a rubber pipe passing around the lower portion of the field coil. The armature coils are wound in such a manner as to permit the air to circulate freely between them. The iron core is built up of laminated sections of soft sheet iron which are so arranged that an air space is left between them. The shaft of the armature has a longitudinal hole extending from the commutator end to a point near the opposite end of the armature. Radial holes are bored in the shaft and meet the longitudinal hole bored in the centre of the shaft. These holes are placed in such a manner that all parts of the iron core and armature coils are subjected to a continuous current of cold air.

Experiments with this machine have proved that the original theories in regard to the effects produced in the practical operation were correct and that when (as is often the case) a static discharge takes place between two armature coils and is followed by the dynamic current, the blast of air will blow out any arc that may tend to form between the coils. Another advantage claimed for this form of construction is that any foreign matter, such as moisture, dust or dirt, will be blown away from the armature, thus preventing the disastrous burn-outs that so often occur from these substances coming in contact with the armature coils.

The application of the principle is not restricted to dynamos and stationary motors, but can also be advantageously applied to street car motors.

A company has been organized in Chicago, under the title of Burt's Electric Light, Fuel and Power Company to exploit and control the inventions of Mr. Burt. Branch companies are now organizing in various parts of the United States to control the state rights. The Armour Electric Light, Fuel and Power Company, of Illinois, has been the first to secure a state right.

Mr Burt, the inventor of the dynamo illustrated, has pending applications for patents on a complete system of electric lighting, including lamps and other accessories, and also on street car motors.



Burt's Patent Self-Ventilating Dynamo.

AN ELECTRIC LIGHTING DIFFICULTY IN CHICAGO.

While trying to secure a better system of street lighting for his constituents, Alderman Burke ran against a snag that will take considerable work to remove. It seems that several years ago, the Chicago Arc Light and Power Company secured an exclusive franchise for running their conduits and wires through the streets and alleys in the alderman's district. Although the franchise is still in existence the Arc Light and Power Co. refuse to run their wires through the streets or to allow any other company to serve customers. There are at present two companies that desire to enter into contracts to furnish light and power. The Archer Light Company and the Consumers Pure Ice Company are ready to furnish electric light at cheaper rates than light is now furnished by the gas companies. At present there seems to be no alternative for the alderman's constituents but to continue using gas.

THE TELEPHONE AND ACOUSTICS.

This topic was the subject of a very able and interesting lecture, given a few nights ago by Prof. Charles R. Cross, of the Massachusetts Institute of Technology, before the members of the Thomson Scientific Club.

To aid him in explaining "The Acoustic Principles Underlying the Operation of the Telephone," which was the full title of the lecture, Prof. Cross used some very elaborate apparatus with which he showed many beautiful experiments demonstrating the value and importance of the three elements of sound, loudness or intensity, pitch and quality.

Of the three characteristics of sound, intensity is due to the energy of vibration and pitch to the rate of vibration ; while quality establishes, as it were, the form of sound. A note of a certain pitch is the same, no matter what instrument is used, because a certain number of vibrations per second are necessary to produce it. As in the case of a tuning fork which gives out the note middle C, making 256 vibrations per second, so the same number of vibrations would be required to sound the same note on a piano-string, or with a trumpet or a drum-head.

That pitch depends on the rate of vibration was shown by an instrument which originated in the time of Galileo, consisting of a simple toothed wheel revolved at a rapid rate. When in motion the edge of a card was held against the teeth producing a shrill note, a descending scale of notes being produced by the card as the speed of the wheel was diminished.

The quality of sound is the most important thing to understand to learn the principles of telephony. While pitch depends on the rate and loudness on the intensity of vibration, quality is due to the form of vibration. The term "form" is used in the philosophical investigation of the subject because the names of different qualities of sound might be illustrated by diagrams, showing the undulations.

While the basic or fundamental tone of any pitch of sound has the same unalterable rate of vibration there are always present many other tones, called over-tones, which are produced by dividing the area of vibration. For instance a piano-string vibrated as a whole, has but one pitch, but by subdividing its length a group of partial tones are produced. These were illustrated by vibrating a piano-string first as a whole, then in sections. Quality, therefore, differs according to the partial tones. It is the quality of the human voice which is transmitted by telephone.

To illustrate this the lecturer described the physiology of the human voice, using a model of the larynx. Within the cavity of the larynx are two membranes, stretching loosely across it when passive, with their thin edges approaching each other so as to leave only a narrow slit. In the act of using the voice these membranes are tightened by muscular action, and the air, forced through the slit, causes them to vibrate and produce sound. Under control of the muscles the membranes are tightened or relaxed to produce a wide scale of sound. Harshness in the voice is due to thickening of the membranes, and when affected by colds the edges become clotted with mucus which interferes with the sound of the voice.

A knowledge of the physiology of the human larynx has made it possible to supply artificial voices to persons who have been deprived of the one nature gave them, and a number of cases exist where the cavity has been opened, and a larynx made of suitable material with rubber membranes has been inserted and become practically useful in speech.

The quality of sound may be strengthened by resonance, illustrated by lectures with several brass spheres, a sound produced over the open apertures in the spheres being much louder or stronger in consequence of the vibrations of air in the spheres producing a different quality. An ordinary bottle is a familiar resonator. The human

mouth forms a resonator, while the lips, tongue, teeth, cheeks and palate effect changes in the quality of sounds coming from the larynx. Without the use of the mouth to alter the quality the vocal cords produce the scale of musical notes and the sounds corresponding to the pronunciation of the vowel sounds. In the mouth cavity these fundamental sounds are changed in quality so as to produce speech. This was illustrated by means of an ordinary Jew's harp.

To transmit the human voice through the telephone it is necessary that all the changing qualities produced by the larynx and its resonator, the mouth, shall be carried over the wire.

The lecturer said that he was unable to explain the vital point of the means by which the electric current carries the sound without disturbing the quality. It is something that is still among the mysteries which science has not yet been able to unravel. There is also doubt as to whether the current passes in the wire or on the outside of it. Even the term "electric current" might not be a proper one to use, when the real operations of electric force are finally revealed; but by whatever process the quality of sound is transmitted, it is sufficient to know that it is transmitted without change.

It has been suggested that a series of broken currents might effect the result, but by a simple demonstration the lecturer proved the contrary. He put in motion an electrical device by which a tuning-fork was vibrated, sending an interrupted current to an ordinary telephone receiver. Nothing but a sharp, snapping sound was heard, with no reproduction of the musical note of the fork. Professor Cross is of opinion that the theory of an undulatory current, rather than a broken one, is better established.

FROM NEWS CENTRES.

BOSTON.

BOSTON, Dec. 12.—Messrs. H. A. and J. W. Howard, New England agents for the well-known C. & C. motors, report business in large motors still brisk, though the demand has necessarily fallen off with the advent of cold weather. They have on exhibition in their offices the first dental engine operated by electricity in this city. The motor is fixed to the ceiling and is connected to the dental instrument, which hangs from above and can readily be used at any and every angle, there being nothing to get in the way of either patient or operator.

The rapid transit scheme for Boston is gradually narrowing down to one or two of the more feasible plans submitted. Mr. H. M. Whitney, president of the West End Railway Co., appeared before the Commissioners a few days ago and made a very explicit statement as to the feeling of the company with which he is identified on this all absorbing topic. The solution of the problem, in Mr. Whitney's opinion, lies in the construction of a double track tunnel beginning in Adams Square near the north end of Washington St., going up Brattle St., into Tremont St., and along the latter as far as Warrenton St., which practically means right through the heart of the city underground; the surface roads still to be used from those two points for reaching all other parts of the city and suburbs. Mr. Whitney's four years administration of the Boston street railway system has been characterized by such intelligent enterprise and success that his opinions and suggestions will carry great weight with every one concerned.

Work will begin at the Thomson-Houston factory at Lynn next week on a new passenger electric locomotive which is calculated to develop a speed of 40 miles an hour. The design is that of a handsome closed car with an entirely new type of truck. The locomotive will have 60,000 pounds draw-bar pull, will weigh 16 tons and have motors aggregating 350 h. p. Professor Thomson has more than once expressed the opinion that electricity on the railways of the world would sooner or later supersede steam, and this new locomotive is likely to prove a long step forward towards that state of things.

The seventy miles of track owned and operated by the Lynn and Boston Railway Co. is to be equipped throughout by electricity, and it is probable that sooner or later Boston, Lynn, Salem and Newburyport will all be connected by electric roads.

The Eastern Electric Light and Storage Battery Co., of Lowell, Mass., have equipped the 13-story high Ames Building with a storage battery, placed on the roof, to supply current at night and on Sundays and holidays, so as to avoid running the lighting plant in the basement on those days. This company is now doing a very successful business, in house, factory and office lighting by means of storage batteries.

The Thomson-Van Depoele Electric Mining Co. are delivering quite a large number of their well-known electric percussion drills for use in blasting out the bottom of the Mississippi River at Rock Island, Ill. Those already in use there are doing some very effective work.

Last week the Edison Illuminating Co. increased the number of incandescent lamps on their circuits by nearly 1000 lights, while quite a number of 2000 c. p. arc lights were also installed. The business this company is now doing is simply enormous.

Several of the 750 h. p. generators, 13 of which have been ordered by the West End Railway Co. from the Thomson-Houston Electric Co., are now well under way. In order to test them the T.-H. Co. is putting in a 1000 h. p. engine in a building specially erected. These generators are of really colossal proportions. W. S. K.

NEW YORK.

The Rapid Transit discussion at the Commonwealth Club on Friday night was attended by a large and influential gathering. Mr. Simon Stern analyzed the various objections that have been advanced against the Greathead system, and showed that for the most part they are baseless. He criticised severely the plans adopted by the Rapid Transit Commissioners, who he said have disregarded the questions of damage to abutting property, the disturbance of the streets and of the existing lines of transit. He made it clear that the professed intention of the Commission to avoid disturbing the streets was a mere blind, and that the experience through which New Yorkers have just passed will be repeated under probably more aggravating conditions. By way of contrasting this phase of the proposed line with the construction of a road on the Greathead system he stated that when the City and South London Railway was being built the owners of buildings in the immediate neighborhood of the tunnels and the people who passed through the streets under which they were carried did not know that the work was going on, save through the newspapers. By means of a single shaft all the material displaced was taken out, and all the construction material lowered. He referred to the slowness with which the consents of the people along the line of the proposed road are being secured, and expressed some doubt as to whether the necessary funds could be raised. Considering that only 20 per cent. of the necessary consents have so far been given, there seems considerable ground for Mr. Stern's strictures on the subject. He pointed out one thing that a great many New Yorkers do not realize, viz.: that the proposed system will cost four times as much as the Greathead system, and the time taken in construction will be much longer with the former than with the latter. The meeting was unanimous in support of Mr. Stern's views, and from the character of the audience the expression of opinion called forth cannot but have considerable weight.

Dr. J. K. Funk, Treasurer of the National Park, as the head of a recently organized company, is seeking permission from the New Brighton, Staten Island, and the Port Richmond Boards of Trustees to construct electric street railways on Staten Island. It is understood that Erastus Wiman is largely interested in the scheme. The Prohibition Park managers propose to have the road in operation before June.

The statement of Mayor Grant that in point of cleanliness the streets of New York compare favorably with the streets of London is about on a par with his other remark that there is a popular prejudice against underground rapid transit, both of which observations have been received with lively criticism. A leading daily suggests that our chief magistrate has worn smoky spectacles while he was abroad, and has put on glasses of the color of rose as soon as he returns to the city which delights to do him honor. It further states that all returning Americans have been moved to disgust and shame by the contrast, and that no improvement in the cleaning of the streets can be expected from a mayor who, having actually visited London, returns with the opinion that our streets are well enough cleaned already.

Articles of incorporation of the New York Electric Railway Company of Trenton, N. J., have been filed in the office of the Secretary of State. The incorporators are John W. Hyatt of Newark, N. J., and Thomas W. Olcott, Louis Adler, Philip Payne and Benjamin Tuska, of this city. The purpose of the company is to construct and operate railways of all kinds, including surface, elevated and underground roads. The total capital is $250,000, divided into 250 shares of $100 each. The principal offices of the company will be in Jersey City and Albany. Louis Adler is a member of the firm of Hoadley, Lauterbach and Johnson of this city. Mr. Lauterbach, on being questioned about the new company, stated that it intends to develop its own system. It is satisfied with the present outlook of the trolley and underground systems, but thinks favorably of the prospects of the storage battery for traction purposes. The Gas Commission met on the 10th inst. and opened the bids for gas and electric lighting of the city for next year. The several gas companies put in bids at the same rate that the city is now paying. The Brush Electric Lighting Company bid for 151 lamps at 40 cents per night, and 114 at 45 cents; the United States Illuminating company bid for 235 lamps at 40 cents, and 66 at 45 cents; they are now lighting 294 lamps at 40 cents. The East River Electric Light Company bid for 247 lamps at 40 cents and 16 at 60 cents; they are now lighting 138 lamps at 40 cents. The North New York Company bid for 243 lamps at 45 cents; they are now lighting 166 lamps at 45 cents. The Mount Morris Company bid for 154 lamps at 40 cents, the same as their present contract. The Harlem Lighting Company bid for 161 lamps at 40 cents, 15 at 45 cents, and 19 at 50. They are now lighting 156 at 40 and 19 at 50. The bids were referred to the Secretary of the Gas Commission for tabulation and report.

There seems to be a settled opinion that the application for permission to have the electric trolley system on all the surface roads of Brooklyn is about to go through the Brooklyn Board of Aldermen. Those who are "in the swim" state that a deal has been effected by which the Aldermen will be well rewarded for their votes. The "fund" to be distributed is supposed to consist of $250,000 worth of stock in the various roads, and it is understood that negotiations have reached the point when the appointment of trustworthy stakeholders has been made. According to present appearances the deal is likely to go through before the first of the new year.

No such luck as that in prospect for the Brooklyn street railway companies has fallen to the lot of Noah L. Cochen and his associates in the organization in 1887 of the Brooklyn Electric Light and Power Company. After innumerable suits and a long and fruitless siege of the Brooklyn Common Council, these gentlemen have given up in despair the idea of ever doing business in the city of churches, and have incorporated the State Electric Light and Power Company at Albany. The company proposes to furnish arc and incandescent light for cities and towns in the State outside of Brooklyn. G. H. G.

A MAMMOTH AMMETER.

The Weston Electrical Instrument Company, Newark, N. J., has taken a contract to build for the Wilson Aluminum Company, of Leaksville, N. C., a mammoth ammeter capable of registering up to 5000 amperes. This instrument is to be a very large form of the well-known Weston type of ammeter, with some important modifications to meet the requirements of the case. It will have a scale about 14 inches long, divided into 250 parts. Each division will equal 20 amperes and the divisions will be large enough to be easily read to tenths, or 2 amperes, and with care to one ampere. The scale will be made by actual calibration with the full current of 5000 amperes to be measured by the instrument in practical work.

This ammeter will be something unprecedented in electrical measuring instruments, especially when we consider the work which is done by a current of 5000 amperes. Thus in incandescent lighting with the direct current, each 16 candle-power lamp requires about .5 ampere. The current required to standardize this instrument would therefore run 10,000 incandescent lamps. Notwithstanding the enormous strength of the current required, the Weston Electrical Instrument Company can handle it in the regular course of their work, without a single change in their appliances or any special preparation.

The appliances of the company for standardizing work are generally known to be excellent, but it would scarcely be thought that any instrument making firm in the world was in a position to produce in its laboratory such enormous currents as those referred to. Some idea of the extent of the Weston Company's plant can be formed when it is said that the copper conductors in the laboratory used for ammeter work weigh about 4 tons and

that some of the mains have a sectional area of 5 square inches, being capable of carrying a current of 10,000 amperes without inconvenient heating.

PERSONAL NOTES.

Mr. Charles E. Chapin, consulting purchasing agent for central stations, has opened an office at 416 Electrical Exchange building, Liberty Street, New York. Mr. Chapin was for some years with the Waterhouse Electric Manufacturing Company, and afterwards acted in the capacity of purchasing agent for the Sawyer-Man Electric Company. Subsequently he became a partner in the firm of Alexander, Barney and Chapin, a connection which he has just severed in order to enter into business for himself. Mr. Chapin is well and favorably known to the electrical profession throughout the country and we have no doubt that he will be as successful in his new venture as his many friends hope and wish.

Dr. A. F. Mason, general manager of the Simplex Electrical Co., retires Jan. 1st, from the position he has so long filled. Not many men in the electrical field enjoy a wider acquaintance than Dr. Mason, and his retirement from all active work in the electrical industry will elicit many a sincere expression of regret.

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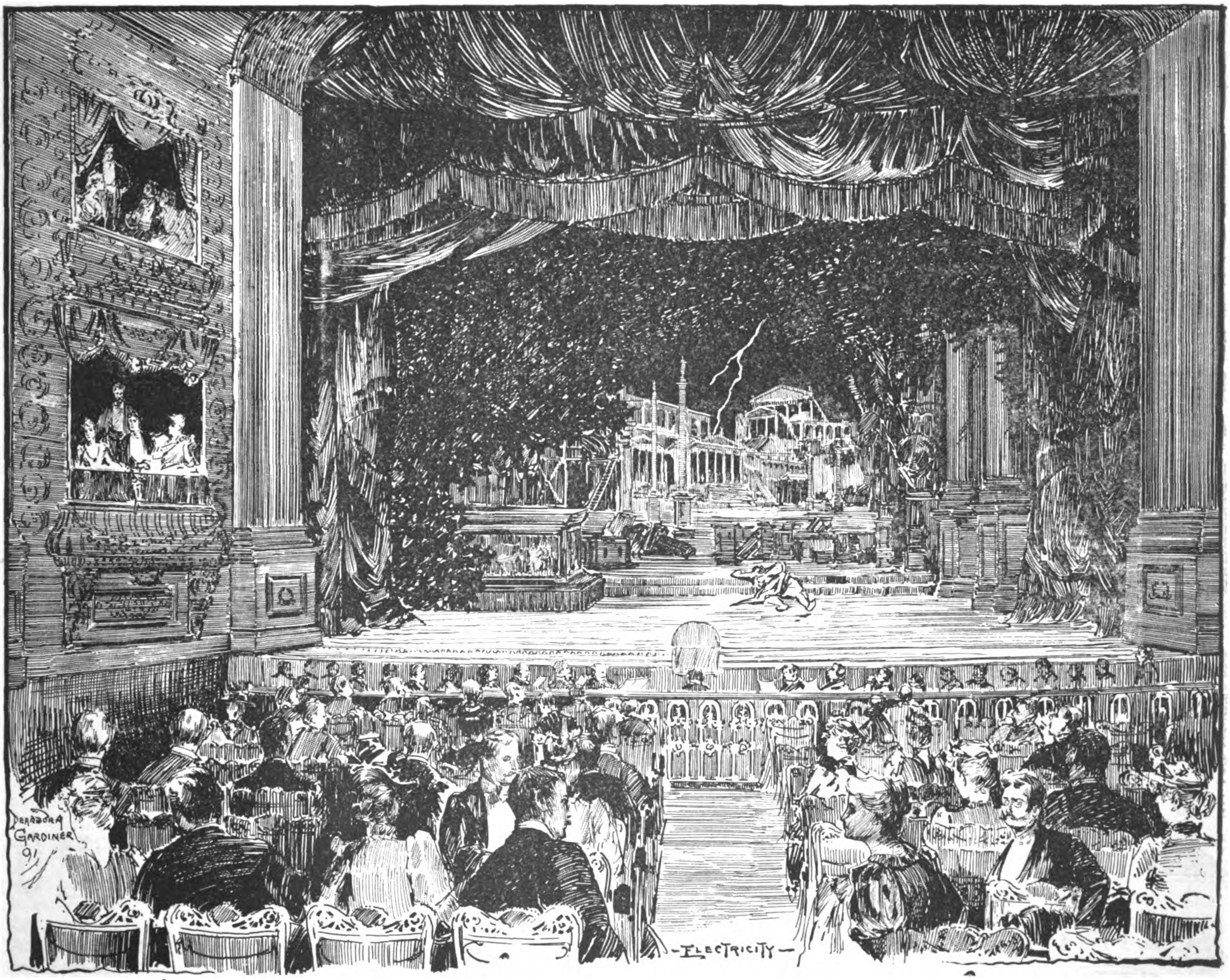
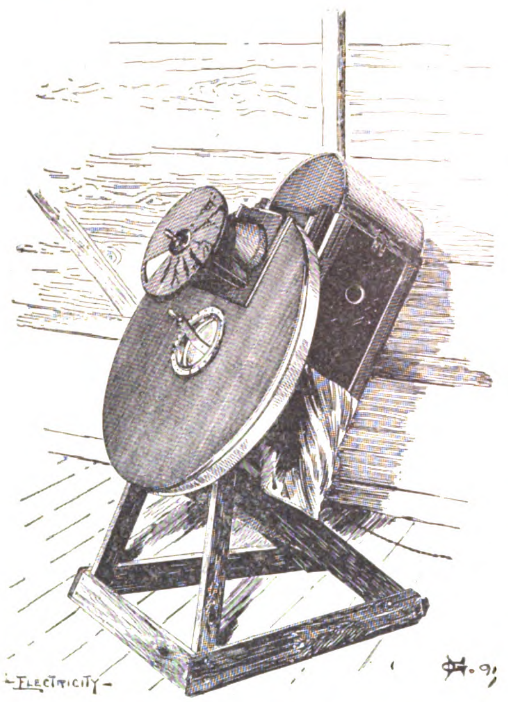


ELECTRICITY IN THE THEATRE—ELECTRICAL LIGHTNING EFFECTS AT THE THALIA THEATRE.

(*See page* 288.)

ELECTRICITY IN THE THEATRE.

In the three hours of an ordinary theatrical performance the public sees the result of months of activity behind the scenes, and of an infinite amount of care and attention to detail. The simulation of nature on the stage is a complex business, and one in which the actor plays a comparatively small part. The efforts of the manager, the stage manager, the scene painter, the property master, the stage carpenter, the electrician, and the master machinist are all enlisted in order to prepare the ground for the final presentment of the play.



ELECTRICITY IN THE THEATRE.—FIG. 2.

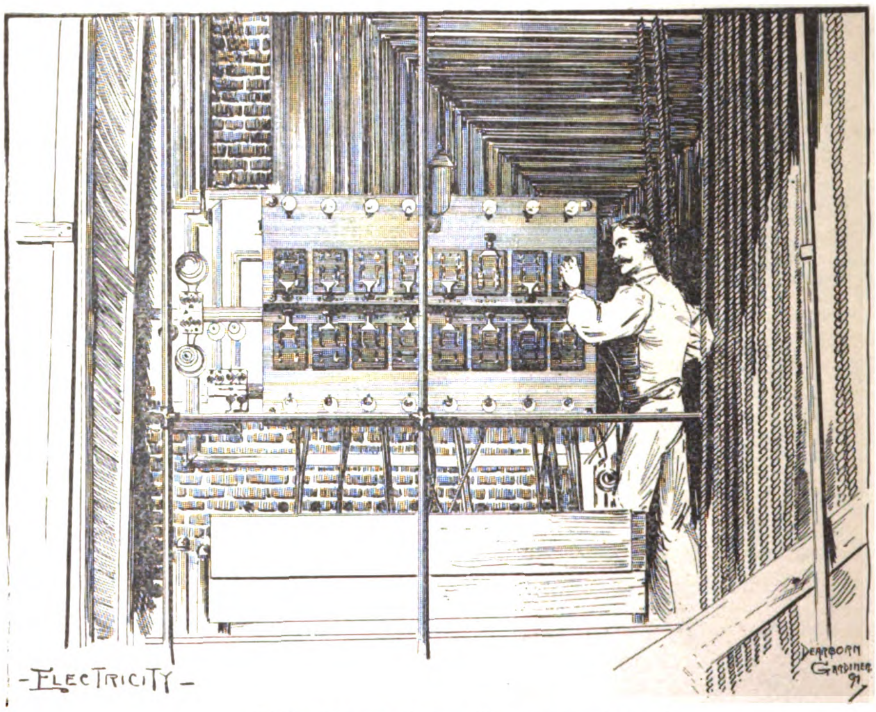
Theatrical performances are to-day dependent to a greater degree than ever before on spectacular effects, and the strides which have been taken in this direction have been so great that it requires something of quite superlative merit in stage setting to elicit more than passing mention. This distinction is certainly attained in the representation of "Julius Caesar" now being given at the Thalia Theatre in this city. The reputation of the Saxe-Meiningen troupe, known as "the Meiningen" in Europe, is well established, and the success of the organization abroad has always been regarded as thoroughly well deserved. Messrs. Carl and Theodore Rosenfeld, who have been the means of introducing the Meiningen to the New York public, have, however, not been content to rely on the ordinary attractions in the way of rich and accurate properties and scenery, by which the performance of that company is wont to be strengthened, but have sought, in the presentment of Julius Caesar, to carry realism to an extent that distances all previous efforts of the kind.

Special reference is now made to the thunderstorm in the third scene of the first act, which is the finest achievement of the kind ever seen in this city. The conditions under which the conspirators discuss the proposed murder of Caesar could hardly be more fitting even in nature, so far as ocular and aural demonstration go. The crescendo from the low moan of the rising wind and the rumble, rapidly dying away of the distant thunder, to the hissing of the raging gale, and the crash of the deafening peal overhead, everything is perfectly carried out. The main dependence, however, of this wonderfully powerful scene is upon the lightning effects, which are exceptionally lurid and realistic. These are produced electrically. Sheet lightning of any degree of brilliance is secured by rubbing together a piece of carbon and a file connected to an electric light circuit. For forked-lightning a specially constructed apparatus is used.

The camera lucida, which is shown in Fig. 2, is made on the principle of a large magic lantern. It contains an arc light, and has in front a revolving disc of dark plates of glass. On these plates are drawn the outlines of the particular kinds of flash desired for projection on the scene, and at the required moment, the disc is rapidly turned by hand and the light is flashed through the instantaneously exposed pattern on the plate. The effect is heightened by having various portions of the scenery painted on some transparent substance, and flashing a light behind them, so that as the forked-lightning plays over the scenery these portions seem luridly illumined by it.

Cloud effects are produced in the same manner, the image being usually thrown on gauze drops. The marvellously faithful production of mimic thunder is attained in various ways. In former days the great resource of the stage manager for the imitation of the artillery of the storm was a sheet of tin, which was shaken with more or less violence as the storm fluctuated. Now, a more elaborate device is adopted, and the making of thunder is reduced to a science. For low, distant rumblings, a thick sheet of vellum is used. This sheet is stretched over a large wooden box, and tightly and securely fastened down. This resonant and sensitive drum is operated on with thickly padded drumsticks. When a larger volume of sound is required, wooden balls of different sizes are rolled around the parchment, and the rise and fall of the sound can be regulated by the manipulation of the balls. For louder peals of thunder wooden troughs about a foot square, which run the entire length of the wall at the back of the stage from the roof to the cellar, are used. In the upper part of these troughs or boxes a number of cannon balls are kept in readiness. At a signal from the stage manager these balls are disengaged, and as they roll down, the noise commences. At first, owing to its distance from the stage, it sounds far away to the audience, but it gathers in volume as it nears the level of the stage, and then dies away as it passes downward to the cellar. The electrical attachment which governs the operation of this device is so arranged that the attendant can control the number of balls to be let loose, so that the amount of noise required can always be accurately given.

For the crashing thunderclap which follows the lightning instantaneously a huge rattle is used. On the top of a box about ten feet long and four feet square are fastened a series of slats. The ends of these slats are rapidly caught by pins on a rapidly-revolving cylinder at the end of the box.



ELECTRICITY IN THE THEATRE.—FIG. 3

As the pins pass upwards the slats drop and a loud continuous rattle is the result. In spite of all these modern improvements, the old stand-by of the stage-manager, the sheet of tin is always in evidence at the Thalia, and there are times when it does excellent service in adding to the din of the storm. Quite as interesting in their way as the other modes of stimulating storm effects are the machines for imitating the sound of rain. Sometimes a slight shower is wanted, when a box containing slanting sheets of tin is called into requisition. These sheets are punctured with small holes, a quantity of peas are thrown in, and as they drop through the holes in the plates the noise of the pattering of rain is heard. The apparatus for producing stage wind consists of a paddle wheel, the paddles of which scrape against a piece of ribbed silk tightly drawn over the upper part of the wheel.

Besides showing these evidences of enterprise and a determination to give to the public the best in their power, Messrs. Rosenfeld were the first to use the electric light in the Thalia theatre. The lighting effects, are under the excellent management of Mr. Carl Walters, who was for some years at the Metropolitan Opera House. The lights are all worked from the Edison circuit. The switchboard is shown in Fig. 3. There are seven switches for the borders and three for the footlights, two of these being for colored lights, and the boxes, the balcony, the second gallery and the dome, are all separately provided for. The effect of colored light on the face of the stage is very simply produced. Between each of the incandescent lamps which constitute the footlights are lamps with tinted bulbs and either of these can be put in circuit separately. In coloring the lamps for stage effects the old tedious hand-painting of the bulbs is entirely superseded by the simple method of dipping the bulb into a bath of varnish of the color required. The lamp is then hung up, and in a few minutes it is ready for use. If the lamp is afterwards wanted for other purposes, it is almost as easily cleaned with alcohol.

In another department of lighting, that of the focussing lamp, the advantages of the supply of current at the Thalia have been turned to account. The stage complement includes five of these lamps. The old calcium light was always a source of uncertainty and trouble to theatrical managers on account of the bulk of the tanks used for holding the oxygen and hydrogen, and the fear of occasional explosion. Besides this the consideration of economy is a serious one. The reduction in the cost of working the focussing lamp over the old

method is in the neighborhood of 300 per cent, to say nothing of the saving in number of hands employed.

Enough has been said to show that in the best and most successful methods of stage management now adopted, electricity has become as indispensable as it is in every other department of business or amusement.

MUNICIPAL ELECTRIC LIGHTING.

A lively war is going on in Cleveland between the gas companies on the one hand and the city authorities on the other. It is a good thing for the local papers, for the gas companies are large customers for space at stiff advertising rates for the purpose of setting forth their claims, and it may be a good thing for the electric light companies, as the city officers are investigating the relative cost of gas and electric lighting, with a view to the possible installation of an electric light plant for the city. Estimates have already been submitted showing that a plant capable of generating current for 2,000 arc lights of 2,000 candle-power each could be put up for between $375,000 and $475,000, and it could be operated at a cost of about $50 per arc light a year. This would give a candle-power five times greater than that at present supplied to the city, at a cost of one-third less. Cleveland has not yet come to the knowledge that municipal electric lighting is beset with a host of stumbling blocks, and that most towns that have adopted it wish they hadn't. Probably the enterprise of the town of Niles, which is in its own state may have stirred up a spirit of emulation in Cleveland. This little town of 6,000 inhabitants, has recently put in an electric light plant at a cost of about $9,000. Fifty lamps are now in operation and the plant will operate fifty more. Warren, Ohio, but a few miles from Niles, leases a plant of the same capacity for $5,000 a year. At the same rate of taxation required for lighting Warren, Niles will pay for her whole electric lighting plant in four years.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the sixty-first meeting of the Institute, held on Wednesday evening last, Prof. Elihu Thomson in the chair, Dr. M. L. Pupin read a paper on "Polyphasal Generators." The paper is a mathematical investigation of the action of generators having a rotary magnetic field of constant strength and will scarcely bear reproduction in these columns. The subject is an interesting one, and the recent experiments of Messrs. Dobrowolsky and Brown in the transmission of power from Lauffen to Frankfort have attracted much attention to polyphasal generators and motors. As Dr. Pupin says in his paper:

"The experimental researches in this new and promising field of electrotechnics are not yet numerous, but still the results already obtained are of so decisive a character as to leave no doubt whatever as to the extremely high practical importance which is attached to electrical generators, motors and transformers constructed according to requirements imposed upon us by this new method of combining a set of variable electromotive forces. For who among us does not thoroughly appreciate the beautiful inventions of Nikola Tesla and the completeness of the success which Dobrowolsky and Brown obtained by practical applications of these inventions?"

MUNICIPAL PLANTS AND THE CONSULTING ELECTRICAL ENGINEER.

BY J. STANFORD BROWN.

"There is not an engineer of national reputation in municipal employ at home or abroad. The talent is engaged in private business or in the employ of private corporations." The foregoing sentence, from the current issue of an electrical journal, indicates most clearly the reason why municipal electrical work is so widely a failure wherever tried—be it in the operation of lighting plants or in the supervision of matters involving the public welfare, as in the oversight of the erection of wires for all purposes. Almost the only prominent violation of the statement, so far as this country is concerned—that of City Electrician Barrett, of Chicago—is the one exception needed according to the old saying, "to prove the rule."

That this state of affairs will not continue indefinitely may, with certainty, be predicted. Here is a wide field for cultivation by the consulting electrical engineer, who, however, to be successful, must not be merely the fledgeling of our college laboratories, but must have won his spurs in his overhauls as well.

In this it is not implied that the writer fails to recognize the importance and value of collegiate training in theoretical principles or the fruitfulness of intellectual culture which are to be derived from the electrical courses now provided at many educational institutions.

Many of us started when no such courses existed, learned the trade, so to say, in the shops and on the poles with spurs at our heels. Theory had to be picked up at night after a 10 hour and often longer day of hard physical labor. And thanks to the electrical journals we have had the path made easy in our search for all that is new in theory and practice at home and abroad. 'Without our weekly electrical papers, ever on the alert to collect the latest information and to spread it far and wide for the benefit alike of professor and student, of superintendent and artisan, this great industry of electrical engineering would never have so wonderful outstripped all other records in the application of science to the material welfare of man.

The student who graduates from a technical college to-day is well equipped and is prepared to enter the field of practical engineering after a much shorter apprenticeship in the manual application of his knowledge than the "old timers" had to serve, but he may not seek to omit such apprenticeship.

To the consulting engineer the municipal authorities can turn in confidence for assistance and find in him that fund of information which, so far, they have seemingly failed to extract from either the agents of the parent companies or from the experience of their brother aldermen in neighboring cities.

A FORGOTTEN TELEGRAPH PIONEER.

At a recent meeting of the Institution of Electrical Engineers (London) a portrait of Mr. Jacob Brett, the first promoter of submarine telegraphs, was presented to the Institution by Miss Alice Bolton, a young lady artist, who painted the portrait herself for this special purpose. In seconding the vote of thanks accorded to Miss Bolton by the meeting, Mr. Latimer Clark gave the following very interesting account of Mr. Brett's life-work:

"Mr. Jacob Brett is now 83 years of age, and I grieve to say he lies on a sick bed through an accident which occurred to him some time ago in getting out of a vehicle; one of his legs was injured, and as the wound has reached the surface of the bone it is extremely difficult to heal. It is a great pleasure to me to know that Mr. Jacob Brett has been elected one of the very few honorary members of this Institution; for I feel that in conferring honor on Mr. Brett we have, perhaps unwittingly, conferred an honor upon ourselves.

"I do not think it probable that many of those whom I see present with us this evening can be fully aware of the very important part which Mr. Jacob Brett and his brother, Mr. John Watkins Brett, have played in connection with the history of the introduction of the electric telegraph, and especially the Submarine Electric Telegraph, into the country and into the world. That connection dates back to a past generation, and is much deeper and more important than the world generally is aware of. His brother (Mr. J. W. Brett) and Mr. Brett were close friends and partners, and worked together in all their undertakings. His brother had a considerable fortune, which he was always ready to lavish on the advancement of submarine telegraphy. They began their public labors in 1845, and it is through their energy and devotion to the subject that we, as Englishmen, can claim for ourselves the distinction of having been the pioneers in the introduction of submarine telegraphy, as we can equally claim to have been the first nation to invent the electric telegraph and the first nation to introduce it into practical working. In order to be able to appreciate the early date at which they began their labors, I would remind you that in 1837 Cooke and Wheatstone exhibited the private working of their telegraph from Euston to Camden Town; and the public then, for the first time, became aware of the possibility of the introduction of the electric telegraph as a factor in daily life. During the ensuing years, Sir W. Cooke, by his great business energy, succeeded in establishing telegraphic lines on many of our railways, as, for example, the Norwich and Yarmouth line, the Dalkey atmospheric line, the Northampton and Peterborough, the South Eastern, the Great Western, and others. But on January 1, 1845, an event occurred which startled the public mind, and contributed most powerfully to the advancement of the electric telegraph. On this date occurred the notorious case of the murder of a woman at Slough, by the Quaker, John Tawell, and his arrest was effected by the telegraph. After he had left by train for Paddington, a description of the murderer was forwarded by telegraph, and on his arrival he was seen to enter an omnibus. A detective mounted on the roof, and after watching him through several streets in the city, followed him into a small eating-house in an obscure and narrow alley, and seated himself opposite to him. Having satisfied himself by observation that he was in the presence of the right man, he suddenly accosted him with the question, 'Haven't you just come from Slough?' Tawell's astonishment and his haggard looks at once betrayed his guilt, and he was eventually condemned and hanged for the crime. This episode occurred in 1845, and made a great impression on the public mind, and I have no doubt had its influence on the action of the two brothers Brett: for, on June 16th of that year, they registered 'The General Oceanic Telegraph Company.' I shall have to refer later on to this company, for the moment I only call attention to its date and to the fact that 'The Electric Telegraph Company,' the well-known pioneer telegraph company of Great Britain, was not registered until September 2d in the same year.

"On July 23, 1845, the two brothers laid before Sir Robert Peel and the Government their plans for uniting Dublin Castle with Downing Street, and also for a general system of oceanic and subterranean electric telegraphs, to include the United Kingdom and the Colonies, together with the establishment of a system of postal telegraphs throughout Great Britain. That letter was printed in type by an electric type machine patented by the Bretts, which was exhibited at 29 Parliament Street, and I well remember seeing it at that time. Copies of the letter were extensively distributed, and I believe that the instruments themselves are still in the possession of Mr. Jacob Brett. In the following year, 1846, they applied to the French Government for a concession for a cable to be laid at their own expense from England to France; and in 1847, this concession was granted to Messrs. Brett by his Majesty Louis Philippe, and in 1849 was

further confirmed by Louis Napoleon, the President of the French Republic. They also applied in this year for a Belgian concession, which was granted to them in 1852.

"In 1850 they laid down their first submarine line, the well-known single wire of gutta-percha, which was successfully completed on August 28th, just in time to save their concession. That wire, as we well know, was so slight that it failed almost immediately; but it was followed in 1851 by a permanent cable of a very different character, which, subject to repairs, was working in portions for 20 years or more, in fact no record exists of the date of renewal of the last remaining portions of it. This cable contained four conductors, and was armored with stout iron wires in the usual manner; in fact, it formed the type for all future submarine cables. The success of this line enabled them to form in 1852, 'The Submarine Telegraph Company,' Mr. J. W. Brett himself being one of the directors, which proved one of the most prosperous and successful of cable companies, and has only recently passed into the hands of the British Government.

"In 1853 they laid the first Belgian line, and formed 'The Mediterranean Electric Telegraph Company,' followed by cables to Corsica, Sardinia, Algiers and many other places, while they were incessantly active in pushing forward their great scheme for a line of cables across the Mediterranean to Egypt, the Red Sea, India and Australia. Mr. J. W. Brett was also a Director of 'The British and Irish Magnetic Telegraph Company,' which in combination with others formed so powerful a rival to the Electric Telegraph Company.

"Now it must ever be a source of surprise that with such records as these the name of Brett should have been omitted or forgotten in 1866, when the somewhat lavish distribution of honors and titles was made in consideration of the splendid success of the Atlantic undertaking; and that surprise will not be diminished when I proceed to show you, that Mr. J. W. Brett was himself the originator, and one of the earliest and strongest supporters of that project.

"I have said that on the 16th June, 1845, Mr. Jacob Brett had registered at the Joint Stock Companies' office 'the General Oceanic Telegraph Company,' the first telegraphic undertaking ever registered. I have seen the original certificate and receipt. But what is more curious is that even at that early date the application goes on to say: 'Object specified: To form a connecting mode of communication by telegraphic means from the British Islands and across the Atlantic Ocean to Nova Scotia and the Canadas, the Colonies and Continental Kingdoms.' So that we are met by the extraordinary fact that the first telegraphic company ever registered in this country was formed, not with the object of erecting telegraphs on land, but for the purpose of laying a submarine cable across the Atlantic Ocean, and this at a period when the world at large had not even heard of submarine telegraphy. Later on in 1855 we find Mr. J. W. Brett associated with Peter Cooper, Cyrus Field, Dudley Field, Prof. Morse, and other prominent names, in founding the New York, Newfoundland and London Telegraph Company, and I have seen the receipt for the £3,000 which he contributed in 1856 as his share to the common fund. In October, 1856, we find the Memorandum of Association of 'The Atlantic Telegraph Company,' with a capital of £300,000 in 300 shares of £1000 each; and again we find Mr. J. W. Brett's name at the head of the list with a subscription of £25,000, followed by the subscription of a like sum by Cyrus W. Field; and subsequently we find his name at the head of the list of directors of the Atlantic Telegraph Company, which was at first unsuccessful.

"It is most difficult to understand how such splendid services in the cause of Atlantic telegraphy could have gone unrequited and unnoticed. One can only conjecture that he must have impoverished his fortune by his too great liberality in his efforts to advance the cause of submarine telegraphy; so that when the final victory was won, and the hour of triumph and reward came, he was unable to take his place in front, and was left aside unnoticed and forgotten.

"I feel very much gratified that this Institution should possess a portrait of the only survivor of the two brothers whose names will go down to posterity as those of the fathers of submarine telegraphy, and I have therefore the greatest pleasure in seconding the vote of thanks to Miss Alice Bolton. We also owe a debt of gratitude to her and her mother for the affectionate care with which they have assisted Mr. Brett during many long years of public neglect. As for Mr. Brett himself, I regret to say that he is in extremely straitened circumstances. He has for many years subsisted entirely on a pension of £100 a year, which was granted to him from the Civil Service fund, and he has no other means of subsistence. It will ever be regarded as a matter of wonder to future generations that the rulers and merchant princes of the Victorian era, who have derived such splendid benefits from submarine telegraphy, should have permitted two of the noblest of the pioneers of electrical science to thus pass away unnoticed and almost unknown.

"Mr. Brett is, however, fortunately a man of happy and cheerful disposition, and feels amply repaid by the knowledge that the subject to which he devoted his early life has now become of almost infinite importance to mankind; that by day and night myriads of signals are ceaselessly flashing through every ocean, and bearing their priceless messages of love or of commerce, of peace or of war. It is a pleasure to feel that when he shall be called away to his last rest, he will be sustained by the proud consciousness that he has been enabled to confer greater benefits on his country and on the world than any other man now living."

THE CHICAGO EDISON COMPANY.

It has been reported during the week that the Chicago Edison Company has come to the conclusion that their present quarters are entirely too small for the demands, and that arrangements had been made whereby the company has secured control of a piece of property located near the Chicago River. It was also reported that the property occupied by them at present was on the market and for sale. Upon investigatian it was found that the story was a daily newspaper fake, and that the Edison Company are entirely suited with their present quarters. A representative of the company to prove the fact stated that they had just received a 500 horse-power engine which will be immediately placed on its foundation and that they expect to add more dynamos to their station in order to keep up to the demands for incandescent lights.

"APPLIED ELECTICITY."

An intelligent inhabitant of the city of culture has lately been entering very enthusiastically into the study of electricity. While intensely interested in the abstract side of the subject, he prefers as much of the concrete as he can compass. Finding that his swill-barrel was being continually ravaged by the dogs, cats and fowls of the neighborhood, he connected wires to a battery in his cellar and ran them out to the barrel, so arranging them that it was impossible for anything to get at its contents without closing the circuit. The devotee of science now watches the approach of the casual beast or fowl with the eager anticipation of the angler who feels a nibbling at his bait. The day after Thanksgiving a hungry yellow dog, irresistibly enticed by the odor of boned turkey, approached the barrel, and tipping it over put his head and paws into the delicious mass. The watcher in the cellar turned the switch and the cur gave a yelp and a backward guide left jump, and the place thereof knew him no longer. A rooster accompanied by a female companion, sauntered up. His comrade first stepped on the plate, and then took one sweeping flight of 150 yards without stopping. The rooster looked around enquiringly, and then took another step. He left without ceremony. As showing how quickly even the lower animals learn to recognize the mysterious force of electricity, it is recorded that the knowing cats of the neighborhood will roost on the top of the barrel, look wistfully in, and go away unsatisfied, preferring rather to go without dinner than to have it mixed with such a condiment. The perverted scientist who is at the bottom of all these experimental aberrations, says that he is acquiring such a fund of knowledge on the subject of the effect of the electric current on the animal tissue that he is in a position to give valuable pointers to the official physician who watches on behalf of the State the electrical killing of criminals.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

Letters have been received by the exposition managers from Herr Wermuth, the German Imperial Commissioner to the World's Fair, that report a very gratifying state of affairs among the German manufacturers. He was in Frankfort on Nov. 25, and from 4 to 6 o'clock in the afternoon held a meeting at the bourse. Commissioner Wermuth spoke for more than an hour, stating clearly and forcibly the advantages that would be gained from a large and well-organized German exhibit, and described the plan and dimensions of the exposition and the ample space and facilities that were offered to German exhibitors. He answered such objections and requests for information as were made, and gave a most favorable account of all that he had seen and heard at Chicago. Toward the close of the meeting a roll was called, and the representatives of the various firms reported their intentions. About thirty, as nearly as could be judged, announced their purpose to exhibit, and a number of others reported that they had the matter under serious consideration. The exhibits from this section will be particularly strong in the following specialties, viz.: Chemicals, wines, perfumery, machinery, electrical machinery and apparatus, leather goods, decorative wrought iron work and the mechanical arts, of which a collective exhibit will probably be made under the auspices of the Kunstgewerbe Schule, one of the most efficient institutions of its class in Germany.

The weather for the past two weeks has been very favorable for the rapid construction of the buildings that are being erected on the World's Fair grounds. The contractors have taken advantage of this, and in many places have nearly doubled their force of men. Over four thousand laborers were employed in the erection of the buildings and grading of the grounds during the last week. It is the desire of all the contractors to get their buildings in shape so that work may continue uninterrupted during the cold weather that usually prevails during the first two months of the year. Contractor Johnson, of the Electricity Building, has added a number of carpenters to his force; he has also employed a larger number of architectural ironworkers, who are engaged in putting together the large iron arches that will span the centre of the building. The first of these arches will be raised into position during the coming week.

The surface of the ground around the Electricity Building is being levelled and prepared for the top dressing of earth suitable for growing plants. A large portion of this work has already been done.

The movable sidewalk erected at the north end of the Fair grounds continues to give satisfaction.

It will undoubtedly be a drawing attraction for visitors to the World's Fair grounds during the coming summer. At present it is more than paying running expenses. During last Sunday 1700 admission tickets were sold. At one time more than 700 passengers were on the platform together. With this load the electric motors did their work apparently as easily as when moving the ordinary load of the track alone.

The McMahon ammonia motor, the invention of P. J. McMahon, is being tested on the railway tracks of the World's Fair grounds daily. A company has been formed to promote this invention, and it is their intention to build and operate a system of cars on the grounds during the exposition for the transportation of passengers if the necessary arrangements can be made with the exposition managers.

The offices of President Bonney, of the World's Congress Auxiliary, have been removed from the Rand-McNally Building to larger quarters in the Home Insurance Building. The committee on the World's Electrical Congress will in future hold its meetings in these rooms. A meeting of this committee will be held this week, on the return of Prof. Elisha Gray, the chairman, from his visit to New York, where he has been in consultation with the American Institute of Electrical Engineers on the subject of the World's Electrical Congress.

A new 150 horse power New Safety engine has arrived on the grounds and will be immediately placed on the foundations that have been prepared for it. It is to be used to run one of the large power generators that has recently been installed for supplying current to the motors used in the various buildings.

At the last meeting of the committee on grounds and buildings the questions submitted by representatives of the firm of Siemens and Halske, of Berlin, were taken up and thoroughly discussed. The question in regard to the amount of space the firm could expect was thoroughly considered and the committee pledged themselves to furnish at least 7000 square feet and as much more as it would be possible to spare. The committee, realizing that it would be impossible at the present time to state the maximum amount of exhibiting space that it could furnish, would not bind itself definitely to anything more than the amount stated above. The committee could not agree to give the amount of space desired by the firm for a street railway exhibit but thought that a track 1500 feet long could be furnished and so arranged that the firm could exhibit their conduit, storage battery, and overhead systems of electric street cars.

An objection was entered against the company operating their electric launches in the lagoons, as the water surrounding the buildings is intended for carrying passengers from one part of the grounds to another and not for exhibitions of mechanical or electrical contrivances. A member of the committee suggested that the firm might operate their boats on the lake between the breakwater and the shore, which will undoubtedly be a much better place to exhibit them, as all the pleasure craft will be required to anchor in this harbor.

The committee could come to no definite arrangement upon the question of allowing the firm to sink a shaft and run a tunnel beneath the mines and mining building to show their mining machines in operation. It was suggested that drawings of the buildings be sent to Messrs. Siemens & Halske and the arrangement they desire submitted to the committee for approval.

The firm desire to exhibit a 1500 H. P. generator and a 1000 H. P. stationary motor. The committee passed a resolution to the effect that they would make room for these machines, but as the floor of the Electricity Building is not calculated to sustain more than a weight of 150 pounds per square foot, it was argued that the machines would be too heavy for this building.

THE ELECTRICAL MARPLOTS.

A STORY OF CHRISTMAS EVE.

Many years ago it occurred to the Western Union Telegraph Company that instead of buying materials for their extensive business, they could more profitably embark in the manufacture of their own materials. They therefore started a factory at 55th Street and North River, where they employed some 40 or 50 hands. These hands were a nondescript lot composed of various nationalities, but nearly all possessed the idea that a practical joke was one of the things best worth living for in this transitory life.

The factory was in charge of Geo. M. Phelps, the father of the highly esteemed president of the *Electrical Engineer*, and his assistant was P. L. Watson, on whom now devolves the superintendence of the Fire Alarm Telegraph of the Brooklyn Fire Department. Mr. Watson was then the owner of a remarkably handsome dog, which just before the Christmas holidays became the mother of two fine pups. These pups were the envy of the whole staff, and the covetous glances which were thrown at his treasures were so marked as to lead their owner to keep a keen and constant eye over them. Offers of exceptional prices and entreaties were alike of no avail in inducing Mr. Watson to part with either of the pups. One morning, however, they were missing. One of the animals was never heard of again, but it was an open secret that the other was in the possession of one of the factory employees. The stolen property passed rapidly from the hands of one man to another, as the possession of it had come to be regarded in the free and easy community more as a triumph of cleverness than as a moral lapse. So each man stole it from his neighbor, until the last owner so covered his tracks that the whereabouts of the pup was temporarily a mystery. There was about the place at that time a wayward child of fortune named Grimshaw, commonly known as "Grim," whose fingers were fairly itching for the coveted prize. Grimshaw got it into his head that Ellsworth had the pup in hiding, and by way of securing definite information on the subject he went to Newton, a chum of Ellsworth, with whom he lived in an adjacent boarding house. Newton and Ellsworth were two confirmed practical jokers, and although they were everlastingly playing off tricks on each other, they were always ready to combine whenever a "scoop" was to be made. Newton at once "tumbled" to the situation, and encouraging the belief in Grim's mind as to the location of the pup, assured him of his active co-operation in any scheme he might devise for its change of ownership. In the meantime Newton went straight to Ellsworth and told the whole thing, and the two arch plotters hatched a pretty little scheme of their own. They proposed to put up a job on Grim, and this is how they did it:

Ellsworth was supposed to be going to his lodge on Xmas Eve, and Newton and Grim were then to carry out their plan. Arrangements were carefully made, and watches were compared. The understanding was that Grim should be opposite Ellsworth's house exactly at 7.30 with a basket stoutly covered, in which the pup was to be carried away. To avert the suspicion that the passing of the basket through the hall might arouse it was to be hauled up by a string to the second story window, where Newton would be in waiting to receive it and lower it again when freighted. The night before this double-dyed conspiracy was to be put into action Ellsworth and Newton sallied forth in search of something to serve as a substitute for the pup, which, of course, Ellsworth never had. As luck would have it they came across one of the mangiest and most forlorn looking cats in the city. It was the very essence of the disreputable caterwauler; of enormous frame, but apparently in the last stage of starvation, and altogether a ridiculous object, if it had not been such a pitiable one. The cat was forthwith corralled and taken home, and, incidentally, well fed. The next night Ellsworth, as previously arranged, strolled out, apparently to attend his lodge meeting, but really to dodge around the corner and take in the fun. Punctually at half-past seven Grim was on hand with his basket, and Newton was on the qui vive within the fort. As soon as Ellsworth was out of sight Newton's head appeared above the sill of the second story window. A whistle denoted that the coast was clear, the string was thrown out and the basket was hauled up, and let down again with its precious load. By this time Grim was in an agony of apprehension as to possible detection, and showed his fears so plainly that Newton had to reassure him that all would be well. It afterwards transpired that this trepidation, which Newton could not at the time account for, arose from Grim's suspicion that he was really being led into a trap. His wife had warned him that "those two fellows," Ellsworth and Newton, were notorious schemers, and were laying their plans for the purpose of having him arrested. Grim flew up the street with his quarry, and Newton joined Ellsworth who was in waiting, and the two chuckled at the success of their machinations. On the way home Grim met several of his cronies, who, seeing the big basket, and the evident haste of its bearer, naturally enquired "What was the racket?" Under pledge or secrecy, he told them he had "the pup," and urged them to come home with him and celebrate the triumphant event in a social glass. Upon their arrival the basket was placed on the floor, a foaming can of beer was brought in and the groop stood round expectantly. The strings of the cover were cut and the lid was raised. Grim put in his hand to take out the treasure within, but withdrew it with a short, sharp cry of surprise. It bore the marks of very vicious claws. The onlookers began to scent something, and when the basket was overturned and the bag of bones that had done duty for the supposed prize stood in all its ugliness before them they simply revelled in the richness of the joke. To add to the bitterness of such an expose before his chums, his wife put in her reproaches, among which the inevitable "I told you so" and the consoling "served you right" figured prominently. The news spread like a flash through the factory, and on Grim's next appearance he was greeted with an orchestral salution of every description of cat call in the feline gamut. None enjoyed the joke more than Mr. Phelps himself. The men who had wrought the mischief thought it better to keep out of the way until the resentment of their victim had somewhat subsided; but towards evening Grim made a point of seeing them, and did the very best thing he could have done. Going up to them he said, in a perfectly frank way: "Well! that job was well put up and well carried out, and I give you fellows credit for it." For months after Grim was daily assailed with the reverberating cat call, and even when he would stray into the byways of the city and thought that he had escaped for a while from the clinging remembrance of the fateful night when he turned freebooter, the caustic sadness of a long-drawn out "meaouw" would fall on the ambient air. At length he left the city, and has long since passed out of the recollection of many who will recall the circumstance described on reading these lines.

The Great Indian Peninsular Railway is utilizing old rails as telegraph posts, and they are cheap and durable, as well as strong and inflexible. An extra piece of rail is bolted to the rail at its lower extremity, generally from 4 ft. to 6 ft. long for an ordinary telegraph post. Sometimes two pieces are necessary for specially long poles. This end is then buried in the ground, and the pole is ready for its fixings. The cost is about from eight to ten rupees each, as against from at least twenty to thirty rupees for wooden posts, and even more for galvanized iron uprights.

ELECTRICITY.

THE POPULAR ELECTRICAL JOURNAL.

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A Word About Ourselves. Many of our friends in Chicago have no doubt had brought to their notice the complimentary paragraph referring to Electricity which headed the editorial columns of last week's issue of a western electrical journal. For the benefit of those of our readers whom this amiable production did not reach, we reproduce it below, for it is too good an example of "journalistic amenities" to be allowed to hide its light within the unopened wrappers which litter the central stations of Illinois.

"The newspaper Electricity has suspended publication in Chicago. It is understood that an attempt will be made to resume in New York, providing its backers can be induced to risk further capital in this unfortunate venture. Planned on wrong lines and with a singularly incompetent management, the sheet can only hope to repeat in New York the failure made in Chicago."

Of course productions of this sort are written with a purpose. It is seldom enough that the page in which it appeared contains anything with either point or purpose, but in this case both are sufficiently obvious. The point was that Electricity last week moved its publication offices from Chicago to New York. The purpose of the paragraph was to give the impression that Electricity was about to disappear altogether from the interesting field of electrical journalism. It is needless to say that Electricity has no intention of doing any such thing; it is on a perfectly solid foundation, and, like the famous young giantess, is "still growing." The various compliments which our ably conducted and ably edited contemporary pays us are worthy of acknowledgement. It is seldom that a journal so freely advertises a competitor in its own editorial columns, and we cannot let the opportunity pass without tendering our sincere thanks.

* * *

New York Rapid Transit. Nothing in New York journalism is more extraordinary than the persistent championship by the New York *Sun* of the elevated railways and its abuse of the underground electric railway scheme, which if properly carried out would give congested New York permanent relief from the transportation difficulties from which it suffers so patiently. The *Sun* thinks that Mayor Grant expressed the feeling of the people when he said that they object to travelling through a hole in the ground. We fancy that the sentimental objection against travelling in a tunnel would have very little weight with New Yorkers if the tunnel would provide them with a quick service and liberate them from the dawdling discomforts of the elevated railways and gross tyranny of their management. At this time of year but little can be said against the elevateds, because they are taxed far beyond their utmost capacity, but it is in the summer that their desire to serve the public honestly is shown to have no existence. At that time of year, when owing to the absence of a large proportion of the population of the city the remainder might reasonably hope to travel in comfort for a few months, the number of trains and the number of cars in a train are reduced with the result that the overcrowding and the delay are just as aggravating as in the winter. The newspaper which upholds a corporation so soulless as this one in its treatment of the public can have but few sympathizers, and it is certainly true that in its ridiculous opposition to underground electric traction and its still more ridiculous championship of the antiquated elevated system the *Sun* stands practically alone.

* * *

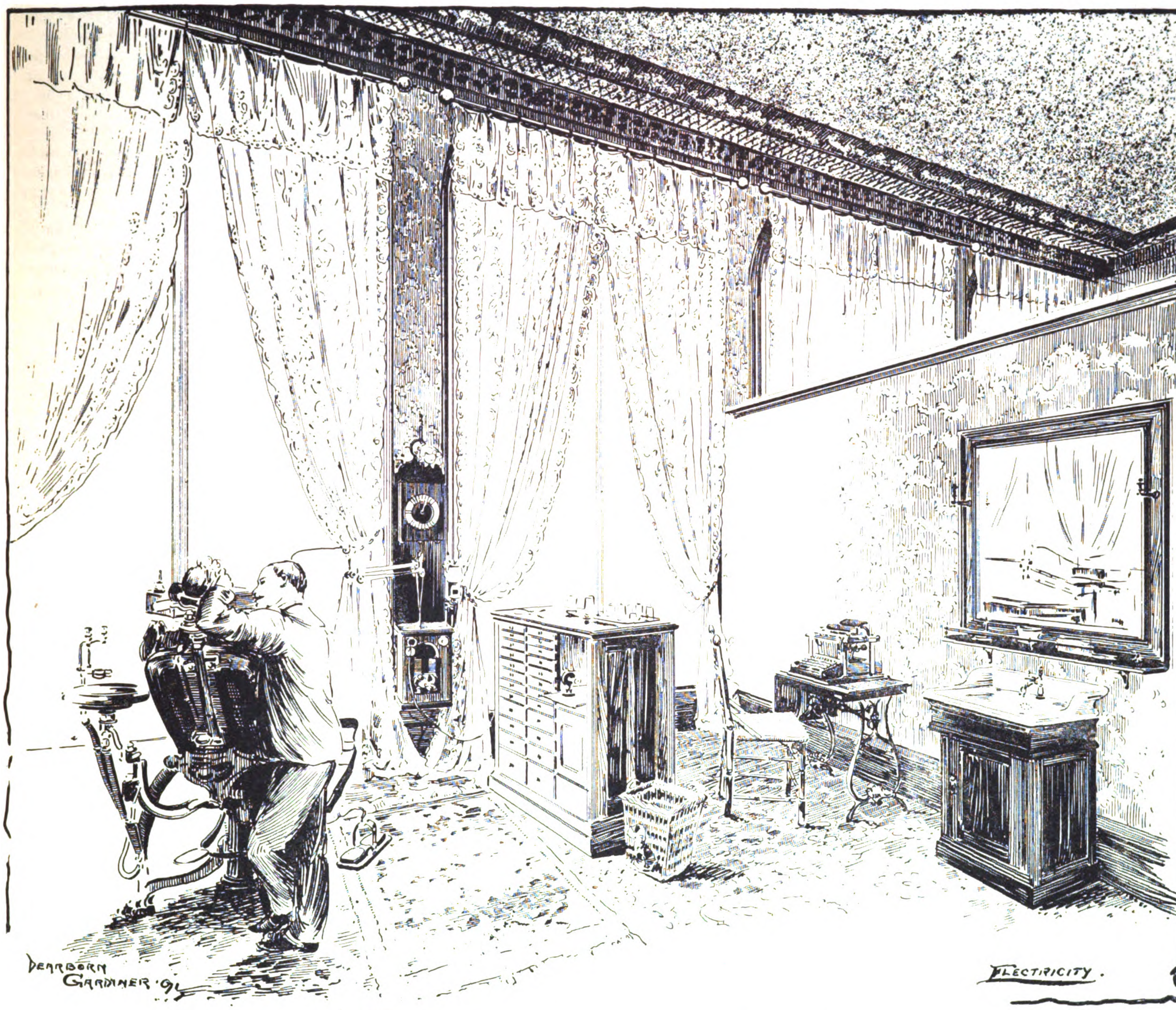
The Electric Light and The Eye. A correspondence is just now being carried on in the columns of a London daily paper discussing the injurious effect of the electric light on the eyesight. This is becoming rather a trite subject, and that it is so often brought up in the newspapers is probably due solely to the fact that the incandescent lamp on account of its harmlessness is not treated with the wholesome respect inspired by a flaming gas-jet or a glaring lamp. People place incandescent lamps on a level with their eyes and within a foot of their noses simply because the small amount of heat which they give out does not absolutely prevent them from doing so. Then in a short time they complain that the electric light is harmful to the eyes. The great advantages which the incandescent lamp possesses over other illuminants—those of absence of smell and vitiation of the atmosphere and small development of heat—are the very qualities that have aided in giving it a bad reputation in regard to its effect on the eyesight, but it is indisputable that this result has only been reached through lack of common sense on the part of many users of the electric light. In the discussion referred to one correspondent said that, whether shaded or not, the light from an incandescent light caused him great distress. It is difficult to believe that a properly shaded light of any sort could have this effect unless the person complaining were afflicted by some premature weakness of the eyes. The London *Electrical Review* says that it may be reasonably admitted that to allow the unshaded filament to shine directly on the eye, must have bad results; the same would be true, though perhaps in a lesser degree, of any other form of artificial light. It is thought by a high authority in these matters that it hurts the eye more to look directly at a 16 c.p. incandescent lamp than to look at a gas flame of similar power. With the gas flame the luminous image on the retina covers more surface than it does with the incandescent filament, and consequently the intensity of light on the points covered is greater with the electric light. As the *Review* further points out, it seems that most people are reasonably careful with their lamps, because taking into consideration the widespread use of the incandescent light, really well-grounded complaints of injury to the eyesight are very few. The main question resolves itself into one of properly shaded lamps: there is no doubt that a properly shaded incandescent lamp cannot harmfully influence a fairly healthy eyesight.

* * *

A Forgotten Pioneer. In another part of this issue we print a most interesting and pathetic account of the life of Mr. Jacob Brett, succinctly narrated by Mr. Latimer Clark in a speech at a recent meeting of the Institution of Electrical Engineers. Many of our readers will be surprised to learn that Mr. Brett is the veritable pioneer of submarine telegraphy. In 1850 he laid the first cable that connected two countries separated by the sea. Five years even before that, when land telegraphs had scarcely begun to exist and submarine telegraphy was a thing unheard of, and only thought of by a few enthusiasts, Mr. Brett registered "The General Oceanic Telegraph Company," which had for its objects "to form a connecting mode of communication by telegraphic means from the British Islands and across the Atlantic Ocean to Nova Scotia and the Canadas, the Colonies and Continental Kingdoms." This was the first telegraph company registered in England and it was formed for the purpose of laying an Atlantic cable, a project that was not successfully executed until twenty years later. When the Atlantic cable scheme took definite shape Mr. Brett was one of the foremost of the active spirits who promoted the enterprise. He was one of the founders of the first company and took equal shares with Mr. Cyrus Field in the second, while he was at the head of the list of directors of the Atlantic Telegraph Company, which was finally successful in carrying out the work. It is somewhat mysterious that Mr. Brett, who did so much for submarine telegraphy when it was a weakling with scarcely a spark of vitality, should have profited nothing when it suddenly became a young giant of splendid promise. And in these days, when upward of 130,000 miles of submarine cables interlace the countries of the globe in every direction, it is pathetic in the extreme to know that the veteran who first conceived of the commercial possibility of the submarine telegraph, who staked his whole fortune on that possibility

and clung with unquenchable faith to it through disaster after disaster should now be languishing in ill-health, forgotten and neglected, eking out his lonely existence on a miserly government pension of five hundred dollars a year. It is a strange coincidence indeed that when this sad story comes to light Mr. Cyrus Field, whose name is indissolubly linked with the Atlantic Cable, should also be lying on a bed of sickness, overshadowed by the blight of financial misfortunes. But fortune has treated Mr. Field more kindly than she has Mr. Brett. Mr. Field's confidence in the ultimate success of the Atlantic Cable was repaid him a thousandfold, his subsequent misfortunes have had no connection whatever with that enterprise. But to read the pathetic history of Mr. Brett is sufficient to justify any one in taking a solemn resolution to never, under any circumstances, become a pioneer.

According to the latest statistics there are at present in the United States 1700 electric central stations, employing a nominal capital of $150,202,850. These stations supply current to a total of 183,509 arc lamps and 2,436,374 16-candle glow lamps and develop a force of 459,574-horse power.



Electricity in Dentistry.—The Office of the Dentist of To-day.

"DENTAL ELECTRICS."

BY C. EDMUND KELLS, JR.

Until within the past few years electricity has been used to a very limited extent in dentistry, on account of the annoyance and care attending the maintenance of the battery. To the dentist, of all men, time is money and when he installs a labor-saving device, it must be one in reality, and not only in name. But in the past few years all this has changed, for the general introduction of the low tension electric light current brings to our doors a power available at all times, and free from all objections. The 110 volt current is adapted, as we receive it, to the running of our motors, and can be readily modified for all other purposes to which we may find it applicable, in our line, for the relief of suffering humanity.

The original method of preparing a decayed tooth for filling was by cutting away all softened tooth structure, and shaping the cavity by the aid of sharp instruments, manipulated by the hand. Later, an inventive genius gave great impetus to the improvement in such dental operations, by the invention of what he called a dental engine, a description of which is hardly necessary here, as doubtless most readers of Electricity are, to their sorrow, perfectly familiar with it. In this, the cutting instruments consist practically of small files, of various shapes and sizes, which are capable of being rapidly revolved by the movement of the foot upon the treadle of the machine.

This, as I said before, was a great improvement on the hand instruments, which it may replace in probably 99 per cent. of their work (although hand instruments must be used at times), but it is evident that when it is run by the operator himself, however expert he may be, there are times when, owing to the position he has to assume, his hand must be somewhat unsteady. The movement of the foot naturally causes this, and thus interferes with the delicacy of work of which he would otherwise be capable. If his assistant operates it, it is not so perfectly under his control as it should be. Here, then, is where the adaptability of the electric current is particularly advantageous. An electric motor may be so arranged as to drive the engine at any desired rate of speed, and will always be under the most perfect control.

By means of a pedal switch containing a pair of contacts to be closed by the foot, and connected by a flexible cord, so that it may be moved about the chair, enabling the operator always to assume a suitable and comfortable position, he can direct the current supplied to the motor, and so control his engine without the slightest exertion or incon-

venience. A most important feature of a dental engine is that it can be instantly stopped. This is done by means of an electro-magnetic brake. When the pedal contacts are separated by the motion of the foot, the brake is automatically brought into play, and while the heavy armature is allowed to "run down," the instrument in the mouth is stopped instantly. By "instantly," is meant the $\frac{1}{50}$th part of a second. A self-recording apparatus was made, by which this time was determined, there being no guess work about it. This absolute control of the electric engine renders it far superior to the foot engine, and is naturally of as much importance to the patient, who suffers, as to the operator, who manipulates.

The speed at which the instrument revolves is a very important item, and is readily adjusted to suit the needs of most operators by means of a rheostat, or may be even more greatly varied for special reasons by the most simple means. For most work, a speed of from 3000 to 3500 revolutions per minute is desirable, but in other instances it is better to run it up to 6000. Upon this point the patient is naturally interested, for an exceedingly sensitive tooth may be prepared with less pain by the use of *sharp* burs revolved at very high speed, than in any other way. In fact, I may safely say that the consensus of opinion among dentists is that a good obtundent of sensitive tooth substance is not known, and that high speed and sharp burs are the best means at hand for dealing kindly with our patients.

It is easy to understand that the operation of such an instrument is by no means the same as that of a foot engine, and that a steady hand to guide it, and a delicate touch are of course prime necessities.

The electric mallet for packing gold is an essential in a well appointed dental office; some practitioners use it exclusively, while others prefer to employ it only as a supplement to the hand mallet. This instrument is not designed to work with the full current of 110 volts and provision must be made for reducing the current, for which a simple rheostat is all that is necessary.

If there be any necessity for artificial light, the ordinary electric lamp can be so arranged as to illuminate the mouth most satisfactorily. By using an electric lamp within the mouth for examining purposes, the real condition of the teeth can be seen far better than by daylight. For this purpose the ½-candle power lamp may be operated through the same rheostat used for the mallet. Besides, for the purpose of general examination, the lamp is indispensable for the detection of "dead" teeth, which sometimes cannot be positively detected in any other way. The lamp being placed behind the tooth, so far as to render it translucent, the difference in color between it and its neighbors is at once made apparent, though unrecognizable by any other means. While this method is quite practicable in an ordinary room, to avail one's self fully of its advantages, the room should be darkened, as with oculists for examination of the eye. It often happens when a "dead" tooth has been neglected that it becomes more or less discolored. Bleaching these discolored teeth has long been practised, although the result is not always favorable. Many are the means employed for this purpose, but about all rely mainly on chlorine to accomplish the result, while the method of its application greatly differs. The electric current renders what has always been an uncomfortable procedure an easy operation. All that is required is to fill the cavity in the tooth with salt water, and place the electrodes in the cavity, when chlorine gas will be freely given off. By this method ofttimes the darkest teeth are restored almost to their original color. The supply of current to decompose the solution may be governed by the same rheostat already spoken of.

When by years of constant use, the teeth have become worn down, as occasionally occurs, and when by the wearing away of the protecting enamel, the sensitive parts are exposed, it becomes necessary to relieve the discomfort and pain produced by this condition. This can be done by the application of the actual cautery directly to the sensitive surfaces, and which is not a very painful operation. A fine platinum loop heated to incandescence by the electric current, termed the electric cautery, is the best instrument for this purpose, as the necessary heat may be easily obtained and controlled.

In the foregoing sketch I have detailed the mechanical applications of the electric current in the dental office. In addition, it also has its therapeutic uses. The advantages of the applications of electricity—both galvanic and faradaic—as a remedial agent, have long been known and appreciated. For the reduction of inflammations, resorption of tumors, etc , etc., its success is well-known. For the same purposes, it may be used about the oral cavity. Toothache is not infrequently caused by inflammation of the pulp (usually spoken of as the "nerve") of the tooth, caused by thernal shock, or a mechanical injury, (sometimes in fact it is impossible to determine the cause) and unless this is reduced and controlled, it may result in the death of the pulp. Chronic abscesses will often not yield to any and all of the ordinary means employed for their cure. In these cases, the application of the electric current may be tried, and often with happy results. Thus it will be readily admitted that the uses of electricity in the dental office have become so widely varied, as to render it quite indispensible. Who knows but that in the early future, it may not in some wonderful manner bring about that state of affairs so greatly desired by mankind in general, something quite bordering upon the millennium, and usually spoken of as "Painless Dentistry."

A NATURAL TELEPHONE.

A marvellous tale comes from Dakota of a discovery which has been accidentally made in the mountains northwest of Rapid City. It is stated that there is a natural telephone line between two mountains in the Black Hills range. On each side of a valley, twelve miles in width, stand two high peaks, which tower above the other mountains, and have long been known as landmarks. These mountains are several thousand feet high, and only on rare occasions have they been scaled, so but little is known of their topography. Some weeks ago a party of tourists decided to make the ascent. They divided into two parties, one for each peak, taking with them heliographs for the purpose of signalling to each other across the valley. The ascent was made, and, so the story goes, while the members of one party were preparing to signal to those of the other, one of the party on the north-mountain was surprised to hear voices which apparently came out of the air. He moved his position and the sound was no longer heard. By changing his position several times he discovered that at a certain spot of the mountain he could hear the voices, and it was not long before he discovered that they proceeded from the party on the other mountain. He called the attention of the others to the phenomenon, and when the attention of the opposite party had been attracted it was found that an ordinary conversation in an ordinary tone of voice was plainly heard from one mountain top to the other. There was only one place on the mountain where it could be heard, and this appeared to form a natural telephone. No shouting was necessary, and the words were perfectly distinct. This is rather a tall story to foist on readers of ELECTRICITY, but, assuming it to be true, an explanation may be sought for in the form of the mountains, which might serve as elliptical reflectors of sound, the speakers placing themselves in the foci at each end of the ellipse, and in the low density of the atmosphere at the altitude at which the phenomenon was observed. The Mormon Temple at Salt Lake City, which is of enormous dimensions, is built in the form of a true ellipse, and a person standing in the focus at one end can carry on conversation in a whisper with another who places himself in the focus at the other end.

THE ELECTRIC GIRL IN LONDON.

The "electric girl" is still enjoying great vogue in London. Her performances crowd the Alhambra nightly and a special performance was recently given before a number of members of the royal family, who presented the "Little Georgia Magnet" (by the way, can she be the original Miss Lulu Hurst?) with gifts of jewelry and with their autographs. Mr. George R. Sims, the well-known playwright and journalist, has evidently hit on the secret of the electric girl. He writes as follows in his weekly contribution of current comment to the London sporting paper, the *Referee:*

"I have been performing experiments on the lines of the Little Georgia Magnet, and I have come to the conclusion that there is nothing in it. I put my elbows out in a certain way, and Albert Edward has burst two blood-vessels in trying to lift me. Fortunately they are not important ones. I put Albert Edward on a chair and piled people on top of him, and then lifted the lot easily with my open hands pressed against the chair. Of course, I did it as the little Georgia lady does—by making Albert Edward assist me by using his feet as a lever. The billiard cue trick is simplicity itself. With a little practice I would go on the Alhambra stage and let Sandow, Sampson, Attila and Cyr all push against me together. The show is all right as a show, and no one objects to the little lady getting a good boom, and I am very glad to see the Alhambra crammed nightly because I have put some of the money out of my money-box into its shares; but to pretend that there is any 'mystic power' or special gift about the performance is absurd.

"God Almighty doesn't endow young ladies with gifts hitherto unknown to science in order that they may be boomed at the Alhambra and lectured on by our old friend, Mr. William Bailey. The trick is clever and legitimate enough, but that sober scientific gentleman should sit down and discuss it seriously only shows that the grand old game of spoof is still a popular and a profitable pastime."

SOME UNEXPLAINED ELECTRICAL PHENOMENA. II.

BY NELSON W. PERRY, E.M.

The first of these substances tried was hard glass such as is used in chemical apparatus—in fact the glass used was part of a broken beaker glass finely pulverized. For a long time no results were obtained with this, as very nice adjustment was required. I was finally rewarded, however, with most remarkable results I had besides a galvanometer an electric bell in circuit. The bridge took long to form and I was about to give up the experiment when there was a sudden tap on the bell, then after an interval another and another tap, but in the intervals the bridge resumed its condition of non-conductivity. This behavior continued for one or two minutes, when finally the needle swung around to its maximum deflection and remained there, and the bell rang continuously. After the bell had been ringing for five or ten minutes I disconnected it, but left the instrument in circuit with the battery for the night.

The next morning I found the galvanometer at zero, but on applying gas to the bridge it responded at once with several preliminary kicks, so short of duration, however, as to scarcely move the galvanometer needle, and then complete conductivity was established. Other tubes with glass bridges were made and in every case the rapid kicks were

characteristic of them. This instantaneous assumption and loss of conductivity was one of the strangest of all the peculiar phenomena observed and all attempts to afford an explanation of it have been thus far unsatisfactory. The idea that it might be due to jar or vibration of the instrument was proved incorrect by observing special precautions to prevent any jarring: under these conditions the kicks continued as before and this theory was further disproved by the failure of purposely applied jars to produce the phenomenon.

Condenser action—the sudden breaking down of the dielectric—would seem to be the most plausible explanation, and yet there are reasons why this is negatived also. The glass bridge gave decidedly the most sensitive instrument of any substance tried, but the difficulty of adjustment and the facility with which this adjustment was destroyed prevented the employment of this substance in any practical way. But the use of glass suggested the introduction of a factor in the problem which it was desired to eliminate or at any rate to determine its influence upon the general phenomena observed. Glass, as is well known, possesses the property to a marked degree of condensing moisture, vapors and gases upon its surface. It was readily conceivable that such condensation might continue until the circuit was momentarily closed, when the passage of the current would again break the continuity. While this might explain the "kick," it would not explain the continued conductivity.

To eliminate as far as possible the condensation effect of glass, the next bridge was made of a thin coating of shellac varnish. Such tubes formed with difficulty and the characteristic kick observed with glass was wanting. Conductivity was gradually assumed in gas and gradually disappeared in fresh air and the instruments were not at all delicate; the phenomena, however, were reproduced sufficiently to show that even with this highly insulating bridge the current could be made to pass when the proper conditions were supplied.

All of the above experiments were tried with copper wires or electrodes. Annealed copper wire seemed to give better results than hard copper, but this was attributed to the greater facility afforded by the soft copper of imbedding in its surface the material of the bridge. There seemed to be no difference in the results whether the current passed from the pointed wire to the blunt one or in the opposite direction.

The next series of experiments was instituted to determine the effect of the material of the electrodes upon the behavior of the instrument, and for this purpose wires of silver, gold, platinum, lead, iron, tin and aluminum were tried, with both electrodes of the same material and also with electrodes of different materials. The best results were always obtained when both electrodes were of copper, and the next best when one was of copper. Two very interesting features were observed in this series of experiments—first that very unsatisfactory results were obtained when platinum formed any part of the instrument. Were occlusion the active principle the reverse would be expected. And second—in one instance where the electrodes were copper and aluminum, the instrument on forming was found to be aeolotropic. It conducted electricity well in one direction, but on reversing the connections the galvanometer was not delicate enough to indicate any current whatever. With this particular tube about forty reversals of current were made, and while it always conducted in one direction it never conducted in the opposite direction. The effect of use, however, was to cause its conductivity to gradually disappear until finally the tube would scarcely conduct at all in either direction. The attempt to restore the conductivity by liberal treatment with gas became less and less effective with each trial, until finally the instrument was thrown away as worthless.

Many attempts were made with this same combination—aluminum-palladium oxide-copper—and while they were all more or less successful, the aeolotropism was never so perfect as in the first instrument, but the law was demonstrated that in whatever direction the instrument had first been formed, in that direction would its conductivity be greatest afterwards. This series of experiments was tried in 1888, and I had not then heard of aeolotropism in electric conductors, but on speaking of the matter with Prof. Elihu Thomson he told me that it was already known that aluminum under certain conditions exhibited that property. While I did not explain to him the details of my experiment he was not so much surprised at the results as I expected him to be.

The growth of the current was studied by inserting a telephone in the circuit. When the galvanometer needle moved slowly towards a maximum, the telephone responded with a slight crackling effect similar to that produced by condenser action, but in the case of the instantaneous kicks where glass was used as a bridge there was usually a sharp click.

THE EVOLUTION OF ELECTRICAL MEASUREMENTS.

Mr. A. P. Trotter, in speaking to a discussion on electrical measuring instruments at a recent meeting of the London Institution of Electrical Engineers, said it should be borne in mind that there were three classes of measurement, carried out respectively in laboratories, workshops, and instrument-making factories. When the Society of Telegraph Engineers was first founded, resistances were measured in miles of telegraph wire, and electromotive forces in Daniell's cells. Subsequently, when the name was changed to Society of Telegraph Engineers and Electricians, laboratory methods were employed, but now it was necessary to measure still more scientifically, and to an accuracy worthy of the Institution of Electrical Engineers. He considered the method adopted at Messrs. Willans & Robinson's a laboratory one, and thought the D'Arsonval galvanometer had not come to stay, for "spot watching" was not acceptable to engineers.

SIR WILLIAM THOMSON.

On Friday, November 28th, a portrait of Sir William Thomson, subscribed for by a number of friends to signalize his election to the office of President of the Royal Society, was presented to the Glasgow University by Mr. A. J. Balfour. The hon. gentleman said: "Sir William Thomson has been identified with the University from his very earliest years; since the year 1831 he had been either as a student or as a professor, almost continually concerned with the affairs of that great teaching institution, and he showed, even at an early age, what power he had of dealing with those scientific questions which it has been his great glory to solve. He is one of the very greatest men of science which, in my judgment, so far as I am able to give a judgment on the point, this country has ever produced. The unceasing and astonishing activity of mind which he has displayed on all subjects is familiar to all who have the honor of his acquaintance, but the results to which that activity has led are what really secure him the title to the gratitude of his generation, and to the fame in generations to come. He is another proof, if further proof were required, that the advancement of industrial invention is no bar to triumphs in the most abstract region of scientific research, and that the genius capable of dealing with the most abstract questions of mathematical physics may nevertheless condescend to subserve the material interests of mankind in the manner which, perhaps, those who devote themselves entirely to its interests are seldom able to equal. I, for my part, do not conceal that it is as the man of science rather than as the inventor, that I admire Sir William Thomson. As an inventor he stands in the very first rank of living inventors, and we all of us in our daily life, unconsciously perhaps, are gaining by the work which he has done in electrical and other matters, into the details of which I do not now mean to enter, but which have advanced the practical means of commercial telegraphy to an extent which, I think, only those why have carefully studied the subject are able practically to estimate. I hold this as an article of my faith, that knowledge, as knowledge, quite irrespective of the practical results which may be obtained from it, is almost the highest product which man, as an intellectual animal—as an intellectual being—is capable of pursuing. But even those who do not agree with that estimate of the comparative value of the different objects of human ambition will, at all events, agree with me that when this great speculative intellect is associated with powers which can be used and in this case have been used, to advance the most obvious material interests of the country, the man who is possessed of these powers and so uses them is worthy not only of the highest admiration, but of the deepest gratitude of mankind." —*Electrical Review* (London.)

AN ORIENTAL "MAGNETIC LADY."

Since public attention has lately been directed to the doings of "electric girls" and "magnetic ladies," the following description of the feats of a veritable phenomenon of this class, contributed to the London *Daily Graphic* by a correspondent in India, will no doubt be found interesting:

One day when inspecting some of the temples which are in such numbers all over Benares, I happened by a mere chance to ask my Indian servant as we passed a small but very smart temple in a narrow, crowded street, "Is there anything worth seeing here?" He immediately replied, "Oh, yes; devil woman." Naturally this reply roused my curiosity, and I inquired whether the lady was a difficult person to visit, and whether she was dangerous to approach. Hyder said, "Oh, no, very quiet; no hurt, but very much devil." He further volunteered the fact that two rupees was the fee for a seance.

The chamber was a very small one, with at the end a sort of raised dais on which was crouched a most hideous old woman. She was a mere skeleton, and her face was wizened and shrivelled up as small as an infant's, but a pair of dark eyes seemed to blaze with light. A small lamp was in the room, but even with it I could see that her hair, which was in tangled gray masses about her shoulders, showed a distinct phosphorescent light. Noticing that I was looking at her hair, she raised her shrivelled hands, and taking them through and through the long locks, she made sparks fly out and bright gleams of light show all over it. I saw that the little platform was made of coarse, dull, greenish glass. The woman stood up, and at that moment the old priest brought to the doorway a small goat. It looked in and seemed very frightened. No sooner did the woman raise her hand than it became still, slowly advanced sideways towards her, and, as it reached the platform, fell down and was quickly drawn towards her, lying perfectly passive on its side. She then went through the same sort of thing with a cat, which was brought in a basket, two pigeons, and a snake, making them do all sorts of curious antics, making the snake stand perfectly perpendicular, like a stick or young sapling. The birds she brought to her by a curious drawing process through the air; they did not fly, and they seemed averse to going, but were invisibly compelled to advance to her.

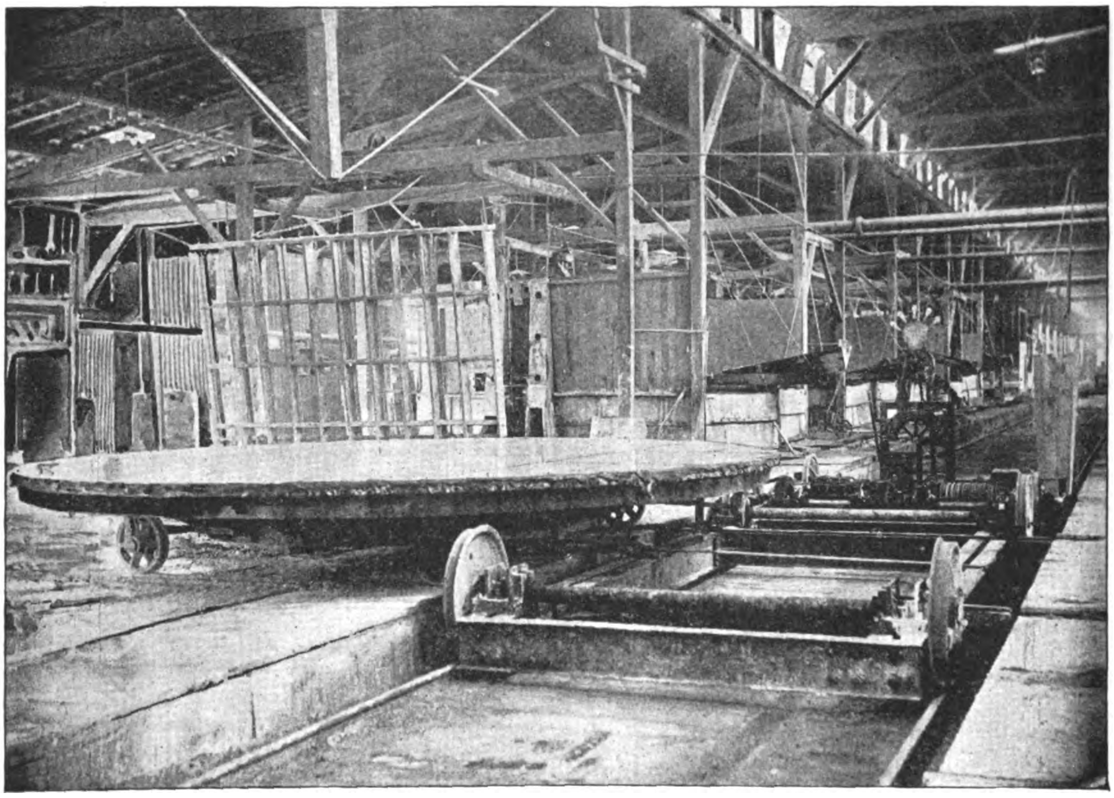
She then asked through my servant whether I would care to be operated on myself, or should they get in a native. I despatched my servant for a coolie. He brought in an exceedingly tall, handsome lad, who had a sort of devil-may-care

expression on his fine face. The woman ordered him to throw off his loose gown, so he had nothing on but a loin-cloth. She then motioned him on to the edge of the platform, and almost immediately after a few passes she placed her hand under his, and slowly raised him off the ground to the height of about two feet, the chamber being so low that he could not get up much higher. She then made a few hypnotic passes, and he became quite stiff, and by a deft turn of her hand she somehow turned his body sideways, and raised him in that position as high as her own breast. She did several other things, and then, placing his arms out straight, signed to me to come and put them down. This I attempted to do, but they were rigid as iron, his fingers and his hips the same, and his eyes, though evidently seeing, did not have the slightest motion. Thoroughly convinced of her powers I then allowed her to practice on myself, and the sensation caused by her even pointing her hand was like an intense discharge from an electric battery into my body, but by no means an unpleasant sensation. She raised me up in the same way as she had done the coolie, and my power was entirely gone and I was under her control completely, but again with rather agreeable sensations than otherwise. On her removing her hands and making evidently one or two back passes, a shivery feeling came over me, and I was able to step down from the rough platform.

TYPESETTING BY TELEPHONE.

The management of the London *Times* has utilized the telephone in a unique way. Telephone wires have been laid in the underground railway tunnel between the composing room in Printing House Square and the Parliamentary reporters' gallery in the House of Commons. A copy ready placed at the telephone, reads the stenographic "turns" from the note-book as fast as it is possible for the compositors to take them on their type-setting machines in the Times Building, a mile and a half away. At first the reporters did not take kindly to the innovation, but when they found that they could dictate their notes direct to the composing room without the trouble of transcribing them, they began to look at the arrangement in an entirely different light. Proofs, of course, are sent to them for correction. Each machine can produce from five to six columns of solid minion a night. Errors will sometimes creep in, but there is no doubt that the practice will become a permanent one. Its great advantage becomes apparent when the fact is considered that the *Times* is able, by adopting it, to print in time for the 5 A. M. newspaper trains going to all points of the United Kingdom the whole of the debates, which are often continued until after 3 A. M.

The *London Electrical Engineer* relates the following instance of quick work in telephony between towns: "A public call-room has recently been opened in Tewkesbury by the Western Counties and South Wales Telephone Company. The *Tewkesbury Record* representative was, at the occasion of the opening, put into communication with Cheltenham, and a report which we have before us was transmitted for press. It was spoken from Tewkesbury to Cheltenham in the limit of time allowed to users of the telephone for communication between towns, and is, we think, one of the smartest pieces of telephone work which has ever taken place. There are 700 words in the report, and to communicate that number of words in three minutes indicates a great deal of smartness on the part of the sender and receiver."



THOMSON-HOUSTON ELECTRIC LOCOMOTIVE.

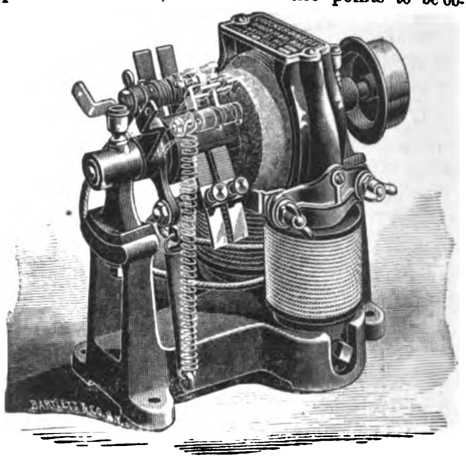
A THOMSON-HOUSTON ELECTRIC LOCOMOTIVE.

We publish herewith a cut showing an electric locomotive at present used in the Pittsburgh Plate Glass Co.'s works at Ford City, Pa., for carrying huge sheets of plate glass from one part of the works to another. At these works there are four electric locomotives in constant use, each being equipped with a 20 h p. motor, the motor is used not only to propel the locomotive, but also to drive a hoisting drum, which, by means of special gears, is thrown in or out at will. Glass is loaded on cars which run on tracks at right angles to the main track, and the hoisting apparatus just mentioned is used to pull these cars up to the tow-cars, which run on the main track and are hauled by the locomotives. The tow-cars are ordinary platform trucks. The grade of the main track is such that the platforms of the trucks are on a level with the side track, and the cars, when loaded, are placed on the trucks and then transferred to any desired point. The gauge of the road is nine feet ten inches, which is probably the broadest gauge ever used in tramway work. The overhead single wire construction is used.

THE CROCKER-WHEELER "ARC" CIRCUIT OR CONSTANT CURRENT MOTORS.

The accompanying illustrations show the general appearance of the perfected "Arc" circuit or constant current motors manufactured by the Crocker-Wheeler Electric Motor Company.

The "Arc" motor offers difficulties peculiar to itself and which are not present with the constant pressure motor, and while the points to be ob-



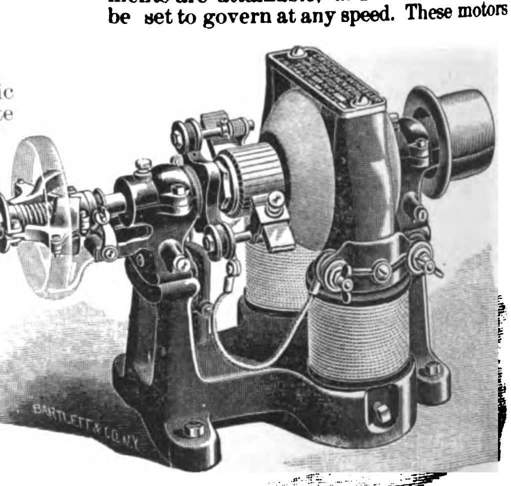
CROCKER-WHEELER ARC MOTOR FIG. 1.

served in setting up and caring for it are the same, the mode of connecting it in circuits and its electrical operation differ widely.

The Crocker-Wheeler Electric Motor Company have experimented with every possible form of governor for arc motors, and now offer a complete series of machines from $\frac{1}{8}$ to 5 H. P., which they have found to govern promptly, without sparking, and to be thoroughly satisfactory in every way. All sizes above $\frac{1}{4}$ H. P. are furnished with automatic centrifugal speed governors (Fig. 2), while the $\frac{1}{8}$ and $\frac{1}{4}$ H. P. motors have regulators to be moved by hand or treadle (Fig. 1). The large sizes can be provided with the hand or treadle form of regulator, if desired.

The hand regulator controls the power and speed of the machine from full power to zero, and at zero automatically cuts the motor out of circuit, thereby saving the current. If the motor is neglected or the regulator not held in the power-giving position by the treadle, the motor is automatically stopped and cut out of circuit by means of a spring attachment. In starting up, the first motion of the regulator restores the circuit, and then gradually reduces the power. Motors provided with the hand regulators are suitable for all kinds of work requiring variation of speed.

The automatically regulated arc motors are provided with an effective centrifugal governor, similar to that of a steam engine. Its construction is extremely solid, the governor being directly upon the main shaft of the motor. The tension of the governor spring is controlled by a heavy nut working on a fine thread, at the extremity of the shaft, by which the nicest adjustments are attainable, and the motor may be set to govern at any speed. These motors



CROCKER-WHEELER ARC MOTOR. FIG. 2.

with automatic governor are suitable for all kinds of work which requires steady speed.

FROM NEWS CENTRES.

BOSTON.

BOSTON, DEC. 19. The Simplex Electrical Co. has just closed a contract with the Edison General Electric Co., for over 1,000,000 feet of wire of various gauges.

As an indication of the increasing popularity of the electric railway in this city Pres. Whitney of

the West End Railway Co., has just announced that the road's net earnings during October increased about $40,000.

There is a very unique electrical display made nightly all over the front of the nine story building owned by Houghton and Dutton, general dealers. Over 800 vari-colored incandescent lamps are arranged in artistic combinations, the title of the firm and "Merry Christmas" being spelt out in lamps. If is by far the most attractive building in the city at present.

An isolated plant of 750 lamps capacity, has just been installed in the new Weeks Building, corner of High and Hartford Streets, many artistic pictures being used. The Edison three-wire system is used.

The Newburyport Car M'f'g Co., has recently finished five electric snow plows for Worcester and three for Lawrence, Mass.

Westinghouse people, and there are a good many of them in Boston, are in high glee over the success of the Pullman "double decker" which the West End Railway is now running regularly. This car is the only one operated by a Westinghouse motor in this city.

Quite a number of electric hoists of 25 H. P. capacity each are under construction at the Thomson-Houston factories in Lynn.

The Eco Magnets Clock Co., of Boston, is placing its well known watchman's clock in many of the largest factories of the country. Quite recently it has installed one in the works of the House Ventilating Stone Co., Tallapoosa, Ga., one in the *Herald* Building, one on Battery Wharf, one in the Columbia Theatre, Boston, one in Phelps Building, Springfield, Mass., and one of 60 stations in Washburn and Moen's factory at Worcester. These clocks are made to give a record from any number of stations.

After two years spent in taking testimony, the case for the United States in the Bell Telephone suit is believed to be complete, and unless something new transpires no more evidence will be taken for the government, although the circuit court has extended the time for taking the evidence until Dec. 24.

A contract for wiring a large new building here, the amount being $2500, has just been secured by Pinkham & Godfrey, a firm which, though young in age, is making an excellent reputation for itself by reason of the first-class work it does.

The Newton Rubber Co., whose hard rubber cells are now in such big demand, reports itself in a position to expeditiously fill orders of any size. Many warm endorsements of the excellent quality of these cells are constantly being received.

Rapid progress is being made with the erection of the new station of the Edison Illuminating Co., which will occupy the old Liverpool Wharf, Atlantic Avenue. It is intended to embody in this station every most recent improvement in central station construction. The other two stations are now taxed to their utmost capacity.

The Wright Electrical Engineering Co. still keeps busy in its own special line, and has just completed the installation of a 200 light plant in the Hartford Rubber Co.'s factory. For the Clinton Gas Co. it has installed two 650 light alternating machines of the Thomson-Houston type, which are operated by the Evans system of friction pulleys, with special outboard bearings.

The Concord Gas Light Co. has just had installed a 12 circuit arc light switchboard, and has had its central station wired throughout by the Wright Electrical Engineering Co.

The Bigelow Carpet Co., of Clinton, Mass., has had 1100 incandescent lamps installed in its big factory, and these will be operated from the local central station.

Since the successful experimental trips with their storage battery car in Sioux City, Ia., during September, a full account of which was published in a recent issue of ELECTRICITY, the Bradbury Stone Storage Battery Co. has enjoyed a big boom, and at the present time is succeeding in getting its efficient specialty into use by other railway companies. The outlook for business in the west is particularly promising.

The Shultz Belting Co., both at its headquarters in St. Louis, Mo., and its eastern branch in Boston, continues shipping goods at a brisk rate to electric light stations all over the country, while its business with Europe is rapidly on the increase. Orders have recently been closed for 15 of its leather woven link belts from Montana: 5 from Washington: 2 from Clinton, Mass., one of which is 30 inches wide, 175 feet long, and one 36 inches wide by 210 feet long.

W. S. R.

MONTREAL.

MONTREAL, DEC. 18.—American firms sending dutiable goods into Canada, either through or in bond, cannot be impressed too strongly with the need of sending two certified invoices with the shipment of the goods. One invoice is necessary for the Canadian purchaser, and the other, signed by the firm and marked certified and correct, for the Custom House. If this be carefully followed, considerable trouble and worry will be saved in endeavoring to pass goods through our rigorous customs, and anything that can be done in this way will be looked upon by Canadian firms as an accommodation.

A collision took place a short time ago between an electric-car and a horse-car in Ottawa. The cab of the electric-car and the side of the horse-car were smashed in. No one was injured, however, although several of the passengers were badly shaken. This is the first trouble of the kind that has happened on this road, which is working with such success. People in Ottawa are very much pleased with the accommodation afforded by the electric railway, and it has already proved indispensable to the city.

There has always been a friendly rivalry between Montreal and Toronto that has shown itself in many different ways. There is one thing, however, which the residents of the metropolis have no hesitation in owning, and that is the superior means of transit enjoyed by the residents of the Queen City. Quite recently a Toronto man wrote to one of our daily journals expressing his opinion of the horse-car service in Montreal. It was very evident that he had had experience of it and by the tone of the letter it was also evident that he had had occasion to go through what many patient Montrealers have to endure. The metropolis yet hopes to be supplied with as good traction as any city of its size.

Tenders have been called for by the city authorities for the construction of the electric road, and Montrealers are waiting with a good deal of interest to see who will obtain the contract to operate them. Could they be once started by an enterprising company, it would not take long for the citizens to appreciate the value of such a system of traction.

The Terrebonne Electric Light Co., of Terrebonne, P. Q., is applying for incorporation, with $12,000 capital, for the purpose of lighting the streets and residences of that town. The Hon. L. R. Masson is one of the directors, and the others are local men.

The Royal Electric Co., of Montreal, has lately installed a 250 volt 5 H. P. motor in the premises of Wm. Ewing & Co., McGill Street, for the purpose of fanning and elevating the grain and also operating a goods hoist.

T. W. Ness has just completed a 50 point telephone switchboard for St. Julie, P. Q. The same firm has also sold a 3 H. P. 110 volt Sprague motor to Carmell & Co., printers.

H. T. B.

NEW YORK.

Sir Ambrose Shea, Governor of the Bahamas, who has just sailed for Nassau, has been for some weeks in New York on an important mission. The English people of the West India Islands have long been convinced of the futility of looking to the mother country for help in the plight to which the failure of their staple industries has brought them. They are consequently looking to their near neighbor for the relief that can be afforded by a free market for their produce, and are seeking to promote in every possible way the interchange of commercial relations. Sir Ambrose Shea has been engaged during his stay in New York in completing arrangements with the Western Union Telegraph Company, which will have the management in this city of the cable about to be laid from Nassau to Florida. The laying of the cable will be begun at the Florida coast, from which it will run for a distance of 230 miles to the West Indian terminal. In Florida it will be connected with the wires of the Western Union, so that the whole of the United States will be put in direct telegraphic communication with New Providence, of which Nassau is the most important port, and thus another line between this country and the West Indies will be established. The completion of this line will be effected at an opportune moment, as it is understood that the negotiations which have been carried on during the last few weeks between our Government and the delegates from the West India Islands for the purpose of establishing a mutually beneficial tariff, have been entirely successful. The West Indians, who know that their practical interests are dependent upon their commercial relations with the United States, in which they find their best market, are greatly cheered by the prospect of a revival of trade and prosperity which has thus been opened out.

The friends of Henry Villard continue to deny the rumor which has been prevalent during the week that Mr. Villard will resign the presidency of the Edison General Electric Company at the forthcoming annual meeting of the stockholders. It is understood that a large number of stockholders in the company are disposed to take exception to Mr. Villard's management. The fact is pointed out that the Edison General is an eight per cent. dividend paying stock, and that the Lake Shore, also an eight per cent. stock, sells for about 125, while the Edison stock is quoted at 91. When Mr. Villard took control of the company its stock sold above par. It is also reported that Mr. Villard's connection with the Northern Pacific Railroad Company is about to be terminated. It is to be hoped that there is insufficient foundation for this rumor. Mr. Villard is an enthusiastic believer in the future of electric traction, and has for some time advocated the building of a great electric railway through the Northwest. He maintains that within the next half decade electricity will supplant steam as a motive power on American railroads. Should the changes of which Wall Street is now talking be made it will leave Mr. Villard free to confine his attention solely to the re-building of the North American Company, in which undertaking his ability as a first-class constructive financier should be of the utmost value.

It was expected that the Brooklyn Aldermen would grant permission on the 14th to the local railroad companies to substitute the trolley system for horses, but the Railroad Committee made no report. It is believed that there is a hitch somewhere, but what it is is not yet known. It is reported that the committee is divided: some members favoring the granting of all the applications, and some inclining to a gradual introduction of the trolley system. A distinct step, however, has been taken in the decision of the General Term of the Superior Court, which has confirmed the report of the commissioners appointed to consider the proposition of the Coney Island and Brooklyn Railway for permission to extend its trolley road into the city limits as far as Ninth Street and Ninth Avenue. This change can be made as soon as the consent of the State Board of Railroad Commissioners is secured, which was practically promised as soon as the favorable action of the Commissioners was obtained. The property of persons opposed to the trolley in Ninth Avenue has been purchased by the company. In spite of the fact that the Railway Committee has declined to express an opinion on the question of the delay in their decision, the general impression is that the trolley system will be approved for use throughout the city, and that Mayor Chapin will indorse the action of the committee.

Owing to the restraining order granted last week by the Judge of the United States Circuit Court of the District of New Jersey, on complaint of the Brush Electric Company and the Consolidated Electric Storage Company, against the Accumulator Company, the works of the latter in Newark have been closed pending a hearing on Jan. 7. The Accumulator Company is summoned on that date to show cause why a permanent injunction against its further operation should not issue.

This decision will affect very important issues in storage battery work.

It has become apparent to the Rapid Transit Commission that the consents of the necessary number of property owners along the line of the proposed road are not to be secured. A large number of property owners have refrained from signing consents because they expected that a commission would be appointed by the Supreme Court "to determine and report after due hearing whether such railway ought to be constructed and operated." Many of those who would otherwise give their consents are under the impression that they by doing so they would waive their rights of recovery of damages in case they or their property should suffer in the construction of the road. At the present rate of progress it would take a year to secure the necessary consents. In all probability applications will be made to the Supreme Court at an early day for the appointment of a commission, which will be required to complete its inquiry and file its report within sixty days after its appointment. In the meantime the Rapid Transit Commission will be pushing on with the preparation of the detailed plans and specifications. When these are ready for final action the next stage of the work, which is the determination of the terms of sale of the franchise, will be reached.

As in the majority of cases where gas is used to supersede the oil lamp it is the immediate forerunner of the electric light, the experiment which was tried on a car of the Broadway line on Friday last is specially interesting to electricians. The car was lighted by gas from 2.30 to 8 P. M. A system of piping was arranged along the ceiling and there were three jets in the car, one at each end and one in the middle. The apparatus for the production of the gas was carried on the car, and is so arranged that when the gas is turned on and the

lights are burning the production of gas goes on, but the production is stopped when the lights are turned down. The experiment is said to have been a decided success.

The argument for a permanent injunction, in behalf of the Consolidated Exchange and the Western Union Telegraph Company to restrain the New York Stock Exchange from excluding the Gold and Stock Telegraph Company from receiving the quotations of the Exchange for distribution on Gold and Stock tickers, was made before Judge Dykman, at White Plains on the 19th. The result was a victory for the Stock Exchange, as Judge Dykman denied the motion with costs.

The consolidation of the American District Telegraph Company and the Mutual District Messenger Campany is understood to be an accomplished fact. New officers of the Mutual Company have been elected and it is intended to eventually have a single set of officers for the two companies, which are now virtually one. The companies say that by acting in harmony they can not only reduce their expenses materially but give very much better service to the public, a fact which the public will highly appreciate. G. H. G.

SPRAGUE, DUNCAN & HUTCHINSON, LIMITED.

One of the most significant signs of the times pointing to the consolidation of the electrical industries on a thoroughly scientific basis is found in the frequent announcements that are made nowadays of prominent electrical engineers taking up the profession of purely consulting engineering. The latest instance of this is the formation of the firm mentioned above, the members of which are too well known to need introduction at our hands. Mr. Frank J. Sprague has made a world wide reputation for himself by his work in electric traction; readers of ELECTRICITY will remember with pleasure the entertaining account of the starting of his pioneer electric railway which Mr. Sprague contributed to some of the early numbers of this journal. Dr. Louis Duncan has long been the head of the electrical department of Johns Hopkins University, and is an electrical expert of high standing. Dr. Cary T. Hutchinson has long been associated with Mr. Sprague in his electric motor work, and is an electrical engineer of well-recognized ability. The business manager of the firm is Mr. Alfred Bishop Mason, a gentleman of wide culture and long business experience. The firm will act as consulting engineers to steam and electric railway companies, advising on all questions of power, light, heat, etc.; also to cities on the construction and operation of electric lighting plants, operation of electric railways, erection of overhead wires and burial of underground ones and all kindred questions. By this announcement it is evident that this firm will confine itself entirely to the consulting branch of the profession, a plan which cannot be too highly commended.

COMMERCIAL PARAGRAPHS.

The Union Electric Works, of Chicago, have secured more orders for their new annunciator drop than is possible for their factory to turn out. The annunciator has been on the market about two months.

W. B. Pearson & Co., Chicago agents for the improved Ball and Wood Engine, have recently sold two 150 H. P. and two 100 H. P. engines to the Chicago Arc Light and Power Company. The engines are to be placed in a temporary station wherever suitable room can be found and are to be used to generate current until the company's station is rebuilt.

"A Few Testimonials" is the title of a neat little pamphlet recently issued by the Electric Merchandise Company of Chicago. If the quotations from letters and the duplicate orders received can be taken as a criterion this company have only entered a field that will in a short time prove extremely remunerative. Among the latest orders received is one from Richmond, Va., duplicating a former order for eight heaters and switches. The company claim that they are giving excellent satisfaction to both patrons and manager.

The Easton Electric Company, Brooklyn, N.Y., has just installed another fifty-five light arc dynamo in the store of Wechsler & Abraham. This makes the fifth dynamo the Easton Company have sold to this well-known firm, and the order being given after eighteen months' trial of the other four dynamos speaks well for the Easton system.

The "Vulca" wire ducts, made by the New York Insulated Wire Co., are meeting with a satisfactory measure of success. They have recently been installed in the new house of Mr. Whitelaw Reid, the Dickson Crucible Works and in large buildings in Warsaw, Milwaukee, Indianapolis and various other places.

A representative of the Kester Electric Co., of Terre Haute, Ind., visited Chicago last week and while in the city secured several large orders. The company report a good demand for their automatic dynamos for incandescent lighting, also for their new motors.

The Delaware Hard Fibre Co., of Wilmington Del., are sending out some samples of their vulcanized fibre which will bear close inspection by those using this class of insulating material.

PERSONAL NOTES.

Mr. J. H. Mason will succeed his brother Dr. A. F. Mason, as general manager of the Simplex Electrical Co.

Mr. W. J. Denver, so well known in telephone circles, has relinquished his position as district superintendent of the New England Telephone and Telegraph Co., and will in future be assistant to Colonel Keller, general manager.

Mr. J. E. Talbot, of the Fort Wayne Electric Co., Fort Wayne, Ind., has been East for the past week or two and received a warm welcome from a large circle of old acquaintances.

Mr. Levi Cofran, probably the best known wire man in New England, and a travelling representative of the Pettingell Andrews Co., is home from a business trip with a plethoric order book.

Mr. J. H Bohombery, President of the Dubuque Street Railway Co., visited Chicago this week.

INCORPORATIONS.

West Jamaica Electric Light Company, Richmond Hill, N. Y.; capital stock, $2,500; manufacture and using electricity for light, heat and power, etc.; pramoters, Geo. Lester, Wm. Kessler, O. W. Graves, all of Richmond Hill, N. Y.

Electric Reduction Company, Albuquerque, N. M.; capital stock, $20,000; reduction of gold, silver and other ores; buying and selling real estate, and buying, selling and mining ores; promoters, A. M. Coddington, J. C. Baldridge, H. B. Ferguson, Frederick H. Kent, E. S. Stover, Calvin Whiting, Chas. E. Winslow, G. W. Harrison, M. S. Otero.

The Belleville Electric Light Co., Belleville, Essex Co., N. J.; capital stock, $100,000; to own, lease, construct, maintain and operate works for the generation, supply and distribution of electricity; promoters, A. F. Crawford, Haverstraw, Rockland Co., N. Y., E. S. Frazer, Mount Vernon, Westchester Co., N. Y., and H. V. Cole, Belleville, Essex Co., N. J.

The National Electric Therapeutic Alarm Co. (incorporated in W. Va.), Washington, D. C.; capital stock, $100,000; manufacturing and buying electric alarm and electro therapeutic apparatus or any other system of electro alarms and controlling and owning patents relating thereto; promoters, Leonides G. Wooly, Grand Rapids, Mich., Frank K. Raymond, Thos. B. Coulter, Washington, D. C.

Newville Electric Light, Heat and Power Company, Newville, Pa.; capital stock, $5,000; furnishing light, heat and power to the boro of Newville, Pa.; promoters, W. G. Stewart, Stacy G. Glauser and Jos. A. Woodburn.

The State Electric Light, Heat and Power Co., Jersey City, N. J.; capital stock, $100,000; to own, lease, construct, maintain and operate works for the generation, supply and distribution of electricity; promoters, H. V. Cole, Belleville, N. J.; Edw. S. Frazer, Mt. Vernon, N. Y.; A. F. Crawford, Haverstraw, N. Y.

The Newark Chandelier Works, Newark, N. J.; capital stock, $25,000; to manufacture gas and electric light fixtures of every kind and description; promoters, L. F. Mergott, W. A. Mergott and A. T. Oppel, N. J.

Massachusetts Wire Co., Malden, Mass.; capital stock, $25,000; to draw and cover any and all kinds of magnet or other wire; to make, buy, sell and deal in all kinds of wire and electrical supplies; buy sell and deal in raw materials for the manufacture of the same; promoters, John S. Bartlett, Lynn, Mass.; Frank Dewing, 620 Atlantic Ave, Boston, Mass.; Jesse Scribner, Waltham, Mass.

New York Electric Railway Co., Jersey City, N. J.; capital stock, $25,000; contracting to build and construct railways of all kinds, including surface, elevated and underground railways and other works of improvements within said States; promoters, T. W. Elcott, N. Y. City, N. Y.; L. Alder, N. Y. City, N. Y.; John W. Hyatt, 141 Commerce St., Newark, N. J.; Philip Payne, N. Y. City, N. Y.; Benjamin Tuska, N. Y. City, N. Y.

Middletown, Highspore and Steelton Street Railway Co., Middletown, Pa.; capital stock, $100,000; operating a street railway by electric power from Middletown to Steelton in Dauphin Co., Pa.; promoters, Geo. W. Cumbler, Swatara, Pa.; Jno. W. Rife, Middletown, Sol. Zimmerman, Lower Swatara, Pa.

Neversink Light, Heat and Power Co., Reading, Pa.; capital stock, $50,000: supplying light, heat and power or any of them by electricity to the public of the city of Reading; promoters, Geo. Brooke, R. T. Leaf, Henry T. Kendall.

Waseca Light and Power Co., Waseca, Minn.; capital stock, $50,000; operate a plant for manufacturing electricity, furnish and supply electricity for light, heat and power, and business incident thereto; promoters, L. P. Ordway, F. L. Benjamin, and Frank Benjamin, St. Paul, Minn.

White Bear Electric Co., White Bear, Minn.; construct, maintain and operate plant for manufacturing electricity; deal in and furnish electricity for light, heat and power, and to do all business connected with manufacturing, generating and distributing electricity; manufacture and repair all necessary appliances necessary in said business; lease, buy and sell real and personal property; promoters, H. E. Byllesby, G. C. Duffie, W. P. Johnson, B. F. Meek, Jr., and H. C. Levis, all of St. Paul, Minn.

The Hornellsville Electric Railway Co., Hornellsville, N. Y.; capital stock, $50,000; to operate a street surface railroad; promoters, Berton McConnell, E. F. Wellets, John Adsit, all of Hornellsville, N. Y.

The Noblesville Light and Ice Co., Noblesville, Hamilton Co., Ind.; capital stock, $25,000; to construct and operate in the city of Noblesville an electric light and ice plant for the purpose of manufacturing and furnishing electric lights and power to said city and the residents thereof, and for manufacturing ice and furnishing cold storage, and to provide proper engines and boilers, machinery, fixtures and appliances necessary for the full and complete management of said light and ice plant; promoters, J. L. Peck, S. J. Peck, and Geo. S. Christian, all of Noblesville, Ind.

Electric Supply and Engineering Co., Detroit, Mich.; capital stock, $25,000; manufacture of electrical machinery and goods; promoters, Wm. H. Fitzgerald, Wm. C. Clark, and Frank C. Teal, all of Detroit, Mich.

Everett Light and Power Co., Everett, Washington; capital stock, $50 000; general electric light and power business in Everett and elsewhere, and any other thing requisite to fully conduct said business; promoters, Henry Hewett, Jr., F. H. Bromwell, Tacomah, Wash.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DEC. 15, 1891.

DYNAMOS AND MOTORS.

465,078. Method of Controlling Alternating Current Induction. Elihu Thomson, Lynn, Mass. Filed April 17, 1889.

465,104. Dynamo Electric Machine. William P. Wiemann, Allegheny, Pa. Filed Dec. 30, 1890.

465,233. Commutator Connection for Dynamo Electric Machines. Carl O. C. Billburgh, Philadelphia, Pa. Filed Oct. 7, 1890.

465,234. Brush Holder for Dynamo Electric Machines or Motors. Carl O. C. Billburg, Philadelphia, Pa. Filed April 25, 1891.

465,202. Electric Motor Switch. Edwin W. Rice, Jr., Lynn, Mass. Filed March 28, 1889.

465,360. Electric Fan. Philip Diehl, Elizabeth, and Edwin H. Bennett, Jr., Bayonne, N. J. Filed April 4, 1891.

465,361. Electric Fan. Philip Diehl, Elizabeth, and Edwin H. Bennett, Jr., Bayonne, N. J. Filed April 8, 1891.

465,404. Switch Actuating Mechanism for Electric Motors. Charles Armstrong, Chicago, Ill. Filed May 11, 1891.

ELECTRIC LAMPS.

465,039. Portable Electric Lamp Holder. John Baker and Henry H. Graham, Indianola, Iowa. Filed March 5, 1891.

ELECTRIC RAILWAYS.

465,034. Electric Car Brake. Edmond Verstraete, St. Louis, Mo. Filed Feb. 5, 1891.

465,359. Converter System for Electric Railways. Mark W. Dewey, Syracuse, N. Y. Filed May 11, 1891.

465,407. Electric Railway. George F. Green, Kalamazoo, Mich. Filed Sept. 17, 1879.

465,432. Electric Railway. George F. Green, Kalamazoo, Mich. Filed May 15, 1886.

TELEGRAPH AND TELEPHONE.

464,959. Telephone. Charles Cuttriss, New York, N. Y. Filed July 22, 1891.

464,979. Electrical Signalling Apparatus. George E. Miller, Lynn, Mass. Filed April 3, 1891.

465,396. Train Signalling Apparatus. Paul Synnestvedt, Chicago, Ill. Filed April 27, 1891.

CONDUCTORS, CONDUITS AND INSULATORS.

464,986. Electric Conductor. William E. Oehrle. Philadelphia, Pa. Filed Sept. 14, 1891.

465,430. Electric Connector. William F. C. Besant, New York, N. Y. Filed May 20, 1890.

MISCELLANEOUS.

464,955. Means for Propelling Boats by Electricity. Otto Busher, Oderburg, near Berlin, Germany. Filed Feb. 10, 1891.

465,080. Rivetting by Electricity. Elias E. Ries, Baltimore, Md. Filed Dec. 10, 1888.

465,250. Process of Extracting Copper Pyrites. Thomas A. Edison, Llewellyn Park, N. J. Filed Feb. 17, 1890.

465,278. Electrical Sewer Gas Indicator. James J. Lawler, Scranton, Pa. Filed March 4, 1891.

465,308. Ships' Course Recorder. Arthur Wrigley and John Hope, Liverpool, Eng. Filed Jan. 14, 1891.

465,349. Magnetic Ore Separator. Clinton M. Ball, Troy, N. Y. Filed Dec. 11, 1890.

465,369. Production of Insulating Coatings or Linings in Electrolytic Apparatus. Ludwig Grabau, Hanover, Germany. Filed August 9, 1887.

465,423. Electric Heater. Warren H. Gove, Syracuse, N. Y. Filed March 21, 1891.

465,426. Electric Switch and Case for the same. Curtis P. Chappell, Providence, R. I. Filed Nov. 4, 1891.

465,442. Electrical Indicating Instrument. Edward Weston, Newark, N. J. Filed March 11, 1892.

ELECTRICITY.

VOL. I. NEW YORK. DECEMBER 30, 1891. CHICAGO. No. 24.

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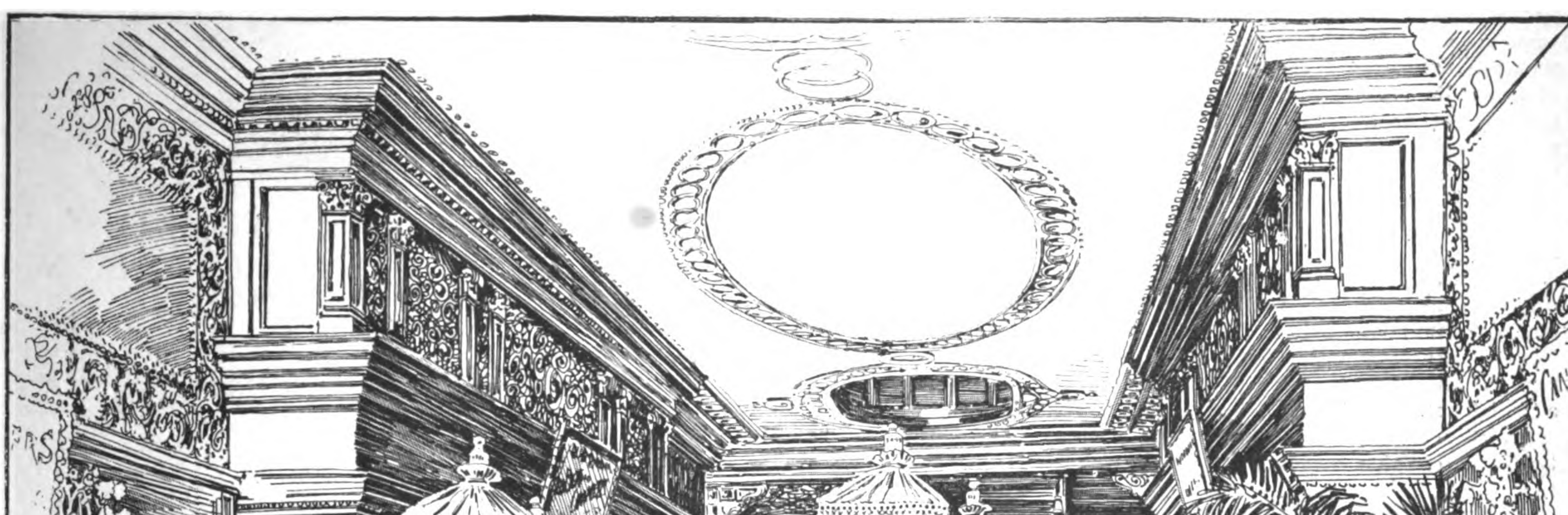
ELECTRICITY.

Vol. I. | New York. | DECEMBER 30, 1891. | Chicago. | No. 24



The Electric Light in Stores—Decorative Electric Lighting at Tenney's Confectionery Store, New York.

(See page 300.)

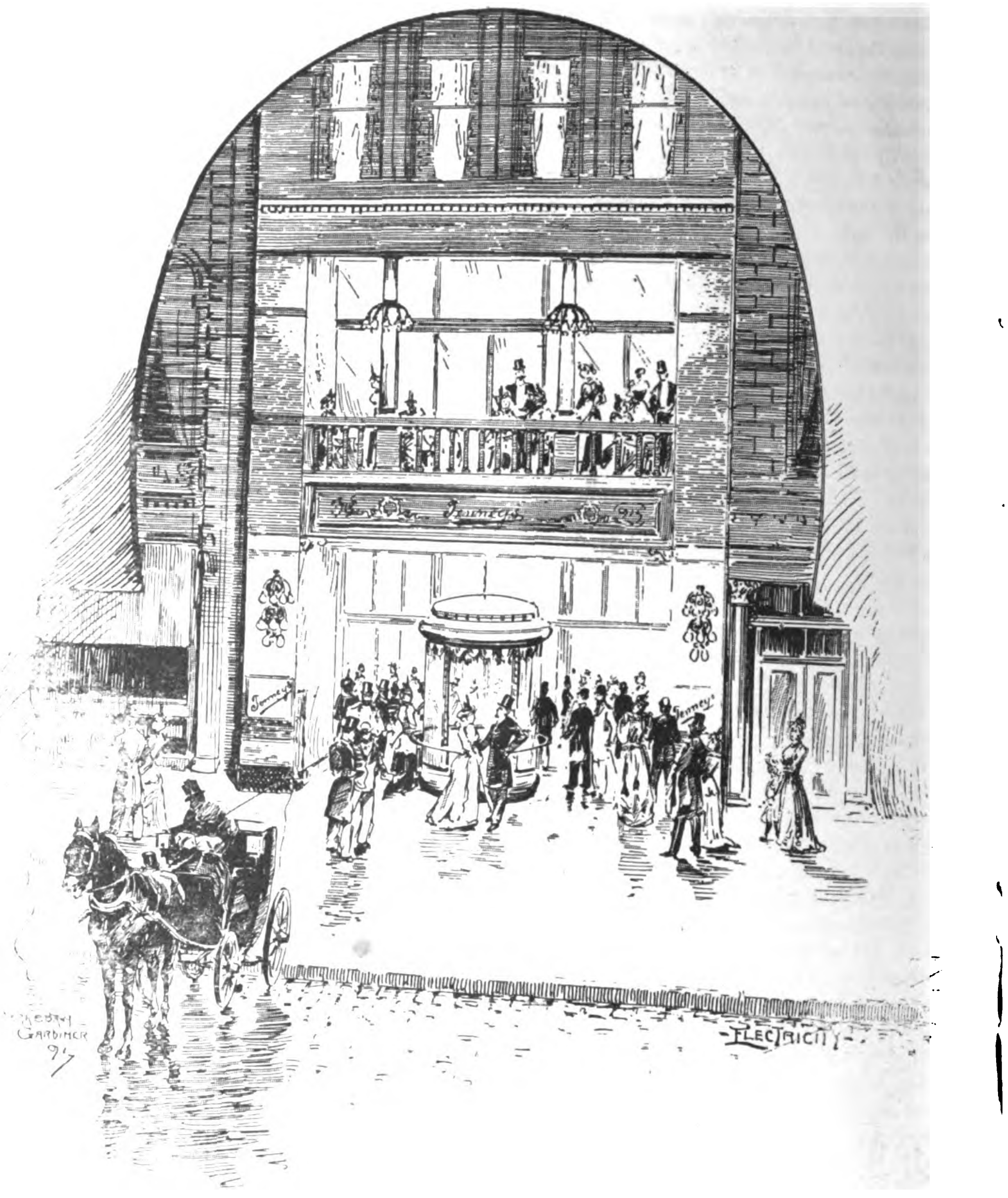
THE ELECTRIC LIGHT IN STORES.

The annual display of Christmas attractions in the stores of New York has usually the same general characteristics. But this year a distinct tendency has been shown to improvement in the lighting of the stores. This tendency has in most instances taken the direction of decorative lighting, to which the electric light lends itself with such remarkable facility and the ornamental effects of light to be seen in the windows of stores on some of the leading thoroughfares have attracted much attention. Proprietors of stores are beginning to recognize that abundance of light alone, essential as it may be to the successful prosecution of business, is not everything, and that to attract the public something more is necessary.

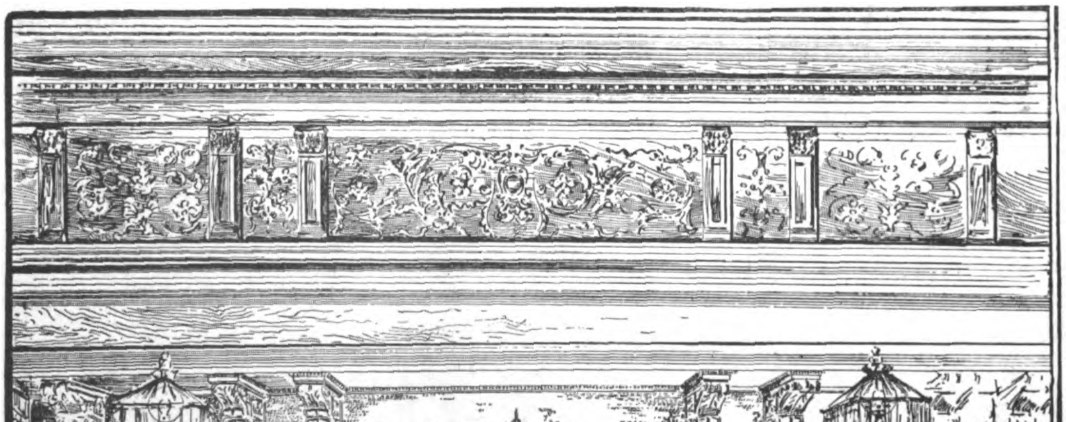
This something is a combination of the judicious disposition of light, its fine gradations, its covering, its accompanying fittings, and its tone or coloring. The shrewd man of business is now giving his serious consideration to all these points, and he finds that the increased attractiveness of his store thereby attained means a solid increment at the bankers.

No better illustration of the effect of this ministering to the growing demand for artistic surroundings can be given than the new building erected by the Tenney Company, confectioners, in Broadway, near Twentieth Street. Throughout the three large rooms, each occupying an entire floor of the building, intended for the use of the public, the greatest taste has been shown in the fittings and decorations, but to the most casual observer it must be evident that the general effect is in a great measure due to the studied use of the electric light, in which a singularly happy discrimination has been exercised.

The entrance to the building, which is on Broadway, consists of a wide vestibule, faced with mosaic and Numidian marble. In the centre is a large pagoda-shaped case for the display of the various forms of confectionery that the firm make a specialty of. This is surmounted by a cluster of seven incandescent lamps, which together with two groups of lights, one on either side of the entrance, constitutes the main illumination of the exterior of the building. On the next floor, immediately above the vestibule, is the loggia, a cool yet cosy piazza, containing ornamental plants, in which it is intended that the visitors to Tenney's shall sip their cocoa in the summer afternoons and evenings and at the same time be able to enjoy a sight of the busy throng in the street below. This loggia is paved with Italian mosaic, the walls being of Venetian glass mosaic, and the ceilings and freize of ornamental plaster decorated in gold and colors. It is made doubly attractive by groups of incandescent lamps which encircle the supporting pillars.



THE ELECTRIC LIGHT IN STORES—EXTERIOR OF TENNEY'S, NEW YORK.



THE ELECTRIC LIGHT IN STORES—INTERIOR OF TENNEY'S, NEW YORK.

As the visitor enters the building on the ground floor, a sight is presented the like of which is not to be seen in the city. Two counters stretch from one end to the other of a large hall. On these are displayed candies of every hue and variety, served by a bevy of girls in artistic and becoming costumes of black and white, more like a recollection of the opera than the garb of the ordinary salesgirl. But the feature which gives to the scene its individuality is a double row of tall, chased silver lamps which are placed a few feet apart down the whole length of the two counters. Rich shades of yellow silk cause a mellow, uniform light to pervade the hall, and the effect is very striking.

This body of light on this floor is increased and pleasantly modified by groups of lamps on the walls. A commendable innovation is the utilization of some of the lamp standards on the counters as soda water fountains. The unsightly accompaniments of that branch of the confectioner's business are thus done away with and the general artistic effect of the apartment is preserved. A

richly carved arch spans the ceiling, and the cashier's desk is resplendent in marble columns, silver capitals and burnished silver screens. The comparative absence of noise strikes the visitor favorably, and is accounted for by the footfalls of the customers being dulled by Oriental rugs, which materially add to the atmosphere of luxury, the production of which has been evidently the special object in view throughout.

On the right of the lower hall a large panelled and carved sideboard rises to the ceiling. Its lower portion is divided into cases for the exhibition of goods, and its large mirror reflects the mosaic mantel opposite. This mantel is a very artistic piece of work. Its main projection is eight feet from the floor, and its walls are covered with old blue Venetian mosaic.

Over the fireplace is a handsome clock of special design, and flanking it on either side are tall silver andirons. The combination is very pleasing, and the effect is greatly enhanced by clusters of flower-like incandescent lamps.

The stairway which leads to the cocoa and light lunch room on the second floor is lighted by incandescent lamps with tinted shades. The cocoa room is finished in oak, the walls being tinted in old rose. The ceiling is of a lighter shade, and the plaster ornaments are relieved with touches of silver. The walls of this room are studded with lights, rows of lamps extending on either side. The tables are also illuminated with lamps in green silver, covered with colored silken shades. A clever provision for the comfort of visitors has been made here in specially designed *tête à tête* tables, which allow two or more people to take their refreshment with the maximum amount of comfort and sociability. A resort like this will doubtless be appreciated by the crowd of shoppers which are wont to throng the stores of Broadway in that part of the city.

On the floor above the cocoa room is the ladies' parlor, and fancy goods salesroom. This is a most attractive room, a veritable symphony in color. It is finished in the Japanese style, the wood-work being ivory white, the walls in delicate cream, and the carpets and hangings of dainty blue and white. The furniture is of enamelled willow and light wood. The soft light of the incandescent lamps make this room into a very pretty picture. The many tables are studded with boxes and baskets, and vases, and all the bric-a-brac incidental to the consumption and packing of every kind of bonbons in the most luxurious manner possible. Besides these are favors for germans, luncheons, and other purposes and every novelty in the confectioner's art. At the end of the room is a pretty suite of ladies' apartments, luxuriously furnished. A customer can come up by the elevator and be waited on here without the trouble of walking around the room. Here too, rest can be taken, letters written or scandal talked galore, and no more cosy place for either purpose can well be imagined.

There is evidently art even in the munching of candies, and the Tenney company have surrounded its votaries with ideal conditions for the prosecution of it.

The plant includes 260 lights, which are supplied from the Edison circuit. The building was wired by the Conduit Wiring Company, and the insulated tubes of the Interior Conduit Company were used throughout.

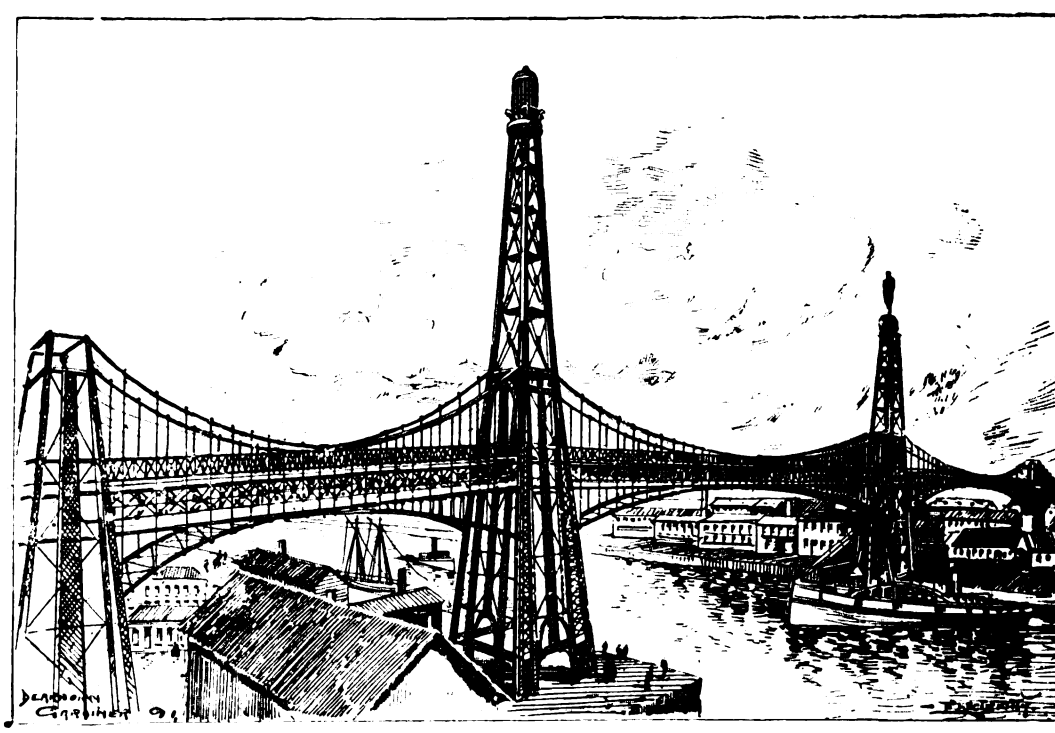
Quite a problem presented itself in the attempt to combine a lamp and a soda water fountain, but this was ingeniously overcome by the Edison Company. This combination is interesting as it is the first instance of the kind, and will probably be the forerunner of a new departure from the antiquated marble soda water fountain. Another new departure in the Tenney Building is the way in which the lights are controlled. In the cashier's alcove is placed a switchboard with 24 switches. By means of this the cashier can instantly turn on or off the lights in the front of the building, in the pagoda show case, the dome over the cashier's desk, and the 16 lamps on the counters. Separate switches also control the lights in the fireplace, the cocoa room, the ladies' parlor and other parts of the building. The decorations were designed by Mr. H. E. Hartwell.

A NOVEL SUSPENSION BRIDGE.

The subject of improved street transit facilities, says the Chicago *Graphic*, is exciting much interest in the minds of the citizens of Chicago, who are taking active measures to insure safe and rapid transit during the World's Fair. The population of the city has increased so rapidly, and the streets are so congested in the business centres, that some relief is positively necessary.

Among the various proposed systems, that which has been advanced showing the feasibility of connecting the North and South Side boulevards of Chicago by a system of bridges carrying electric railway tracks commends itself to the public.

This system, known as "The Day System," provides for a pair of handsome towers, four hundred feet high, to stand on either side of the river, the one surmounted by a light-house, and the other by a colossal statue of Columbus. Elevators at cross streets give access to these bridges, whose aggregate length will be more than a mile, and the elevator shafts will be placed in the supports of the span.



Proposed Suspension Bridge for Chicago.

The height of the bridges will prevent any interference with shipping, and the grade will be so arranged that it can easily be ascended by a horse drawing a heavy load.

A company has been formed with an aggregate capital of $19,000,000, and it is to be hoped that construction will be begun in the near future.

The *Northwestern Railroader*, in commenting upon the proposed structure, says:

"The Day system of bridge construction is a new departure upon the suspension principle. It is a tension frame, providing against the deformations of unequal loads or wind pressure by means of a second cable, curved upwards and connected with the upper cable by vertical or oblique tension members. It is obvious that the so-called elasticity of suspended structures is due to deformation alone. Steel is no more elastic under tensile than under compressive stress, and a single wire anchored at all points firmly by means of vertical ties would be as rigid vertically as a girder.

"The chief distinguishing feature of this proposition, apart from all that has been said, is the small outlay at which such structures can be carried out. Prof. Fleeming Jenkin has made a comparison between the weights of structures of all the usual kinds, neglecting the roadway, which is common to all. A 400 foot span, such as is the standard for the Day system, where no local circumstacces can alter it, would weigh as a simple suspension bridge eighty-three tons, as a girder bridge, 475 tons. The roadway would in either case weigh about 140 tons and the additional cable about forty-five tons, but the balance would still be over fifty per cent. in favor of the tension frame."

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The subjoined resolution, passed by the International Congress Committee and the Council of the American Institute of Electrical Engineers, is the outcome of the recent visit to New York of Dr. Elisha Gray, Chairman of the Committee on Electricity of the World's Congress Auxiliary.

Dr. Gray, after several informal interviews with officers and members of the Institute, was invited to attend a meeting of the Congress Committee on December 16th, where a mutual exchange of views upon the subject was had, and so far as is known the result is entirely satisfactory to all parties interested.

Resolved, That the American Institute of Electrical Engineers, having already taken action during the past three years, by correspondence and otherwise, in relation to the holding of an International Electrical Congress in connection with the World's Columbian Exposition, hereby expresses its desire and intention to co-operate, by all means in its power, with the World's Congress Auxiliary of the World's Columbian Exposition, through its Electrical Committee, in furthering the gathering of such a Congress at Chicago in 1893, and in making it a successful and worthy representation of the best electrical science and practice in all parts of the world.

NEW YORK ELECTRICAL SOCIETY.

This Society will hold its 141st meeting in Professor Chandler's room, School of Mines, Columbia College, this evening. The lecturer of the evening will be Mr. A. A. Knudson, who will speak on the subject of "Frauds in the Electrical Business." The Society has done well to take up this subject, and call attention to the extent to which the public is victimized by the sale of all manner of appliances, the worthlessness of which is concealed under the name "Electrical" or "Magnetic."

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The progress made on all of the Columbian Exposition Buildings for the first year, considering the amount of labor necessary for their construction, has been exceedingly gratifying to the Exposition managers. With the buildings in their present state, there seems to be no fear but that they will be finished and ready for occupancy long before the time called for in the contracts. Most of the building material for the principal buildings has arrived on the grounds, so that there is no danger of delays being caused by strikes in rolling mills, as was recently the case with the Electricity Building.

The report of operations for the year ending December 31 will show that nearly 2,000,000 cubic yards of earth have been moved to make the grounds conform to the shape outlined by the landscape gardener. Nearly all the dredging for the lagoons has been completed.

The amount of lumber that has been sawed and hewn into shape for the construction of all the buildings is estimated at about 50,000,000 feet. The number of tons of iron that has been received and is ready to be placed in position would be hard to estimate, as most of it is in the shape of architectural iron, and has been received by carloads from a number of different firms.

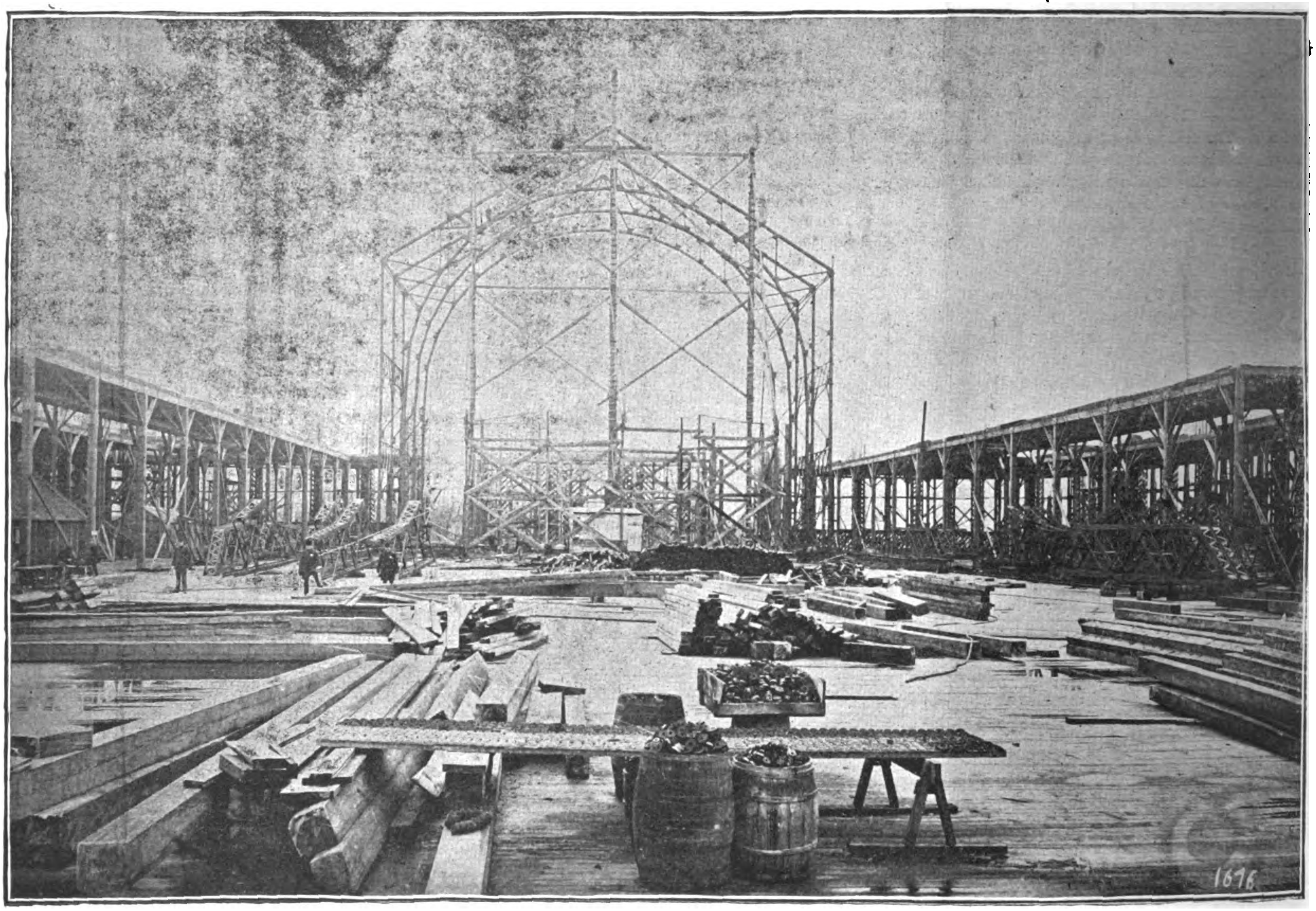
Work is progressing very rapidly on the Electricity Building. As will be seen from our illustrations the iron arches are being placed in position. Fig. 1 shows the present state of the north end of the Electricity Building looking from the centre of the building itself. The iron trusses shown in the cut are 115 feet high and span 110 feet, clear. Each of these supporting arches weighs eighteen tons. Forty of them will be required to support the roof of the building. Fig. 2 is a view of the building from the opposite side of the lagoon, showing the north and west sides of the structure.

As these views show, the greater portion of the work is being done on the northern portion of the building. The contractor, Mr. Johnson, desires to get this part of the structure under cover as soon as possible, so that he can continue his work during the remainder of the winter months.

At a conference of the chiefs of the different departments, held in Chief Burnham's rooms last week, the subject of lighting and supplying the buildings with water and fire apparatus was thoroughly discussed. Nearly all the plans were examined, and the head of each department indicated the positions he desired the lights to occupy in his building. It is the intention of the engineering department to take suggestions and draw up plans for installing electric lights and running the necessary wires.

Fig. 3 is a view of a portion of the temporary power house erected on the grounds. The dynamos and engines shown in the illustration have been added to the station since the other portion of the plant was described and illustrated in ELECTRICITY for November 4. The plant at present consists of a 50 H. P. Ball engine, 100 H. P. Phœnix, 150 H. P. Buckeye, 200 H. P. New Safety, and a 450 H. P. Armington and Sims, or a total of 950 horse power. All of these are belted directly to the dynamos. The electrical equipment consists of four 50-light arc dynamos, two 100-kilowatt power generators and two 30-kilowatt incandescent dynamos. All of the electrical machines and apparatus have been furnished by the Edison General Electric Co., under agreement that they can be returned to the company when the exposition authorities have no further use for them. The use of the engines has been given by the different engine manufacturing companies.

The plant, although for temporary use only, has been installed in a very substantial manner. All the foundations are built of solid masonry. Three 1,000,000 gallon Worthington compound pumps have been added to the station for fire protection. On account of the number of engines of different makes doing practical central station work in the temporary electric light and power plant, it is a very interesting station for those engaged in electrical work to inspect.



Present Condition of the Electricity Building at the World's Fair.—Fig. 1.

SOME UNEXPLAINED ELECTRICAL PHENOMENA. III.

BY NELSON W. PERRY, E. M.

Mr. Geo. Westinghouse, Jr., having heard of my experiments, invited me to exhibit the instrument to him, which I was pleased to do. It was thought that the device could be put to commercial use in detecting the presence of the odorless natural gas as well as water gas, which the Fuel Gas and Electrical Engineering Co. (one of the Westinghouse concerns) was contemplating putting on the market, and at Mr. Westinghouse's request I remained in Pittsburgh about two months endeavoring to bring the instrument into practical working form. A small working laboratory was fitted up for me in the office of the company and an instrument connected with a relay and an electric bell was placed on the wall near the ceiling in the office of Mr. Lemuel Bannister, then general manager of the Fuel Gas and Electrical Engineering Co. The instrument was placed directly over a gas jet; by turning on the gas the bell was set in operation, and on turning it off and ventilating the room it stopped. The operation of the instrument with both illuminating and hydrogen gas was seen by many, and Mr. Chas. H. Terry, of the firm of Pope, Edgecomb and Terry, drew up applications for U. S. patents.

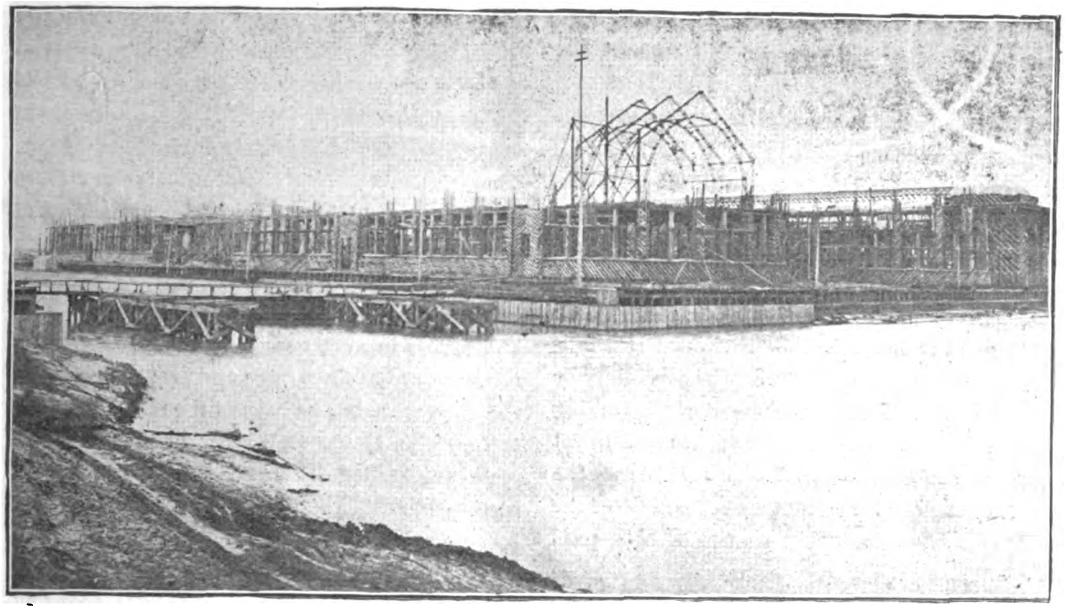
It has been stated that the instrument responded readily to artificially prepared marsh gas, but it utterly failed to work with the Pittsburgh natural

gas. This was in line with the experience of Faraday and others with occlusion, viz.: that while artificially prepared marsh gas was readily occluded by platinum and palladium, the natural article was but slightly so, at ordinary temperatures. A further series has led me to believe that I have discovered the cause of this inertness of the natural article, and has suggested various remedies, which, however, have not been sufficiently tested to demonstrate their utility.

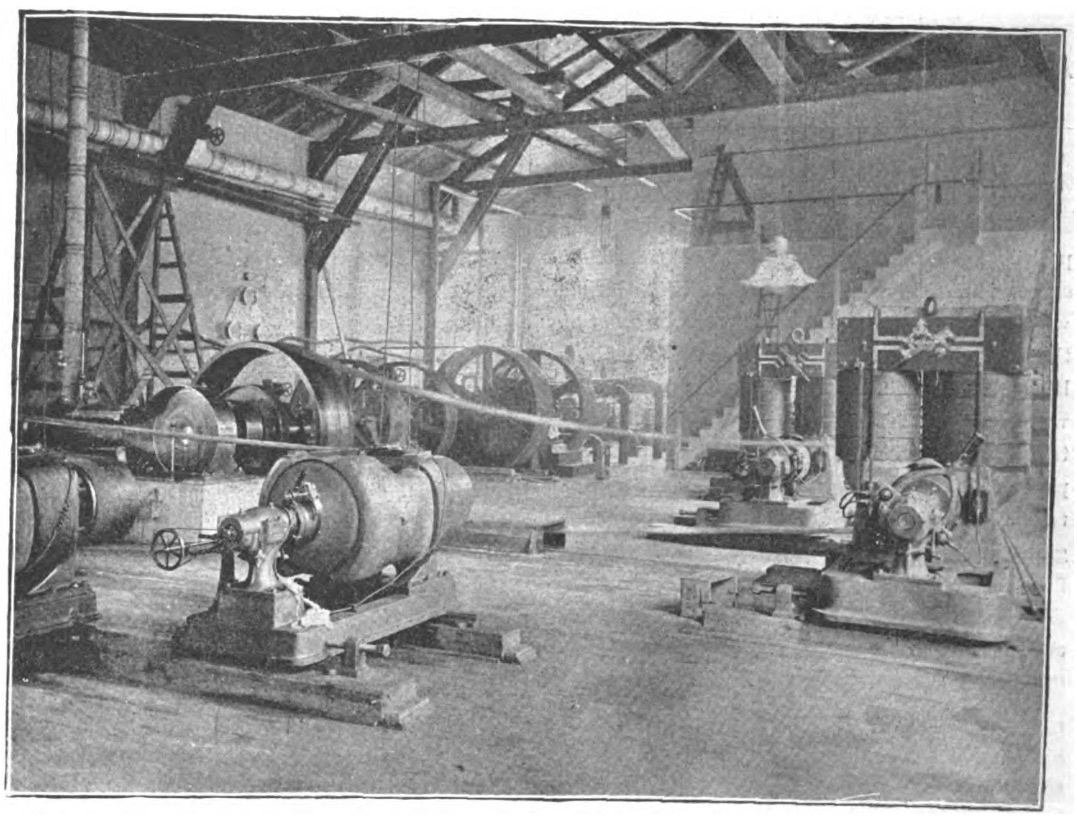
To obtain the results described above requires considerable manual skill or knack, which, with me, was a growth of some time and would probably require as long with others, but when once acquired there is no difficulty in making instruments with considerable rapidity and of great delicacy. The problem was presented to Prof. Ogden N. Rood some three years ago, and although I endeavored to make my descriptions explicit he failed to substantiate any of my results, although for adjustment he employed a micrometer screw capable of accurately measuring one fifty-thousandth of an inch.

A few words should be added in regard to the preparation of the oxide of palladium, which is the best material to experiment with. This is usually prepared by heating the nitrate to incipient redness, but I have never succeeded in making a suitable article from the ready prepared nitrate. I have found it necessary for the best results to prepare my own nitrate and from this to make the oxide. All of the works on chemistry contain misleading statements in regard to the action of nitric acid on metallic palladium. They state that it rapidly dissolves the metal, which is not so when the latter is in the form of foil or wire. A very little will go into solution—just enough to slightly color the acid—when all further action is stopped by the formation of a protecting covering of scale or oxide, which boiling for hours fails to remove. If, however, a little hydrochloric acid be added, the metal goes rapidly into solution, from which it may be precipitated again in the metallic state by a little zinc. This fine metallic powder, after being thoroughly washed, is readily soluble in nitric acid, and, evaporated to dryness and ignited, gives an oxide of the proper quality if too large quantities are not attempted at once. Sometimes, on evaporating down, the residuum is a light frothy brown substance which heat fails to blacken. When this product was obtained I found it best to throw it away, as it was worthless. The residuum should be hard and black with a high lustre, closely resembling India ink which has been rubbed up with water and allowed to dry. With an oxide of this appearance I seldom failed to obtain good results.

In this preliminary announcement I have given only qualitative results. Quantitative results would be more valuable and I hope to be able to furnish them at some future time. I am unable at present to offer any satisfactory explanations of the phenomena observed, though there are certain directions in which it seems they must be sought. These are in the line of the little understood branch of molecular physics, in which I find it necessary to feel my way very carefully before committing myself. In the meantime I hope that those better versed in this subject than I am will come to the rescue and make these dark places light.



PRESENT CONDITION OF THE ELECTRICITY BUILDING AT THE WORLD'S FAIR.—FIG. 2.



TEMPORARY ELECTRIC LIGHT AND POWER PLANT AT THE WORLD'S FAIR GROUNDS.

WATER POWER IN ITALY.

A company has recently been formed in Milan for the utilization of about 600 H. P. from the waters of the river Oglio, in the Mulino di Capriolo district, on the Palazzolo-Paratico Railway, in the production of electrical energy, which will be transmitted a distance of about 12½ miles and distributed in the industrial districts of the province of Bergamo. It is proposed to put down a plant comprising three turbines each of 200 H. P. directly connected to three dynamos of the low tension type.

CURRENT ELECTRICAL TOPICS.

The new Japanese Parliament House, built to replace the one destroyed by fire a short time ago, is now completed. The new building, which is a handsome structure, is lighted throughout by electricity. To illuminate the large hall, two arc lamps of 150 C. P. each are provided.

A prize is offered by the Société des Eaux de la Dranse, in Switzerland, for the best system for the electrical utilization of a fall of water. Particulars of the competition may be had from the Secretary de la Société des Ingenieurs Civils of Paris.

Messrs. Reisser & Co., of Stuttgart, are erecting a power transmission plant of 80 H. P. in connection with the paper mills of Messrs. Kutten & Co. at Wolfegg in Wurtemberg. The water fall from which the necessary power is obtained is about 880 yards distant from the paper mills.

The water of another river—the Sieher—in Switzerland, is to be used in the production of electrical energy. A tunnel 2 miles 1,401 yards in length is to be constructed to convey the water to the central station. The greater part of the energy produced will be utilized for operating an electrical railway between St. Gall, Speicher and Brogen. The remainder, about 800 H. P., will be distributed for lighting or power purposes as required.

The Adelphi Hotel, Liverpool, has just passed into the hands of the Midland Railway Co., and has been thoroughly transformed. On the first floor a telephonic exchange has been erected. There are 200 bedrooms and 25 private sitting rooms or suites of apartments, all fitted with the electric light. Each room is placed in communication with the manager's office by a telephone which will either serve as an ordinary call bell or transmit verbal orders. In the ladies' dressing rooms adjustable electric lights are fixed. The other fittings in the hotel are on a most elaborate scale.

The Oesterreichische Nordw.-Dampfschiffahrts-Gesellschaft have just completed at their Dresden yards what is said to be the largest cargo steamer ever put in service on the upper Elbe. The vessel, which is intended for service between Hamburg and Magdeburg, is 213 ft. long, has triple-expansion engines of 750 H. P., draught 3 ft. 6 in., and is fitted throughout with the electric light.

ELECTRICITY.

THE POPULAR ELECTRICAL JOURNAL.
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Communications relating to subjects within the province of this journal are cordially invited. News notes, descriptions of new devices with drawings or photographs, are at all times desired.

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The 1893 Electrical Congress. The project of holding an International Electrical Congress in connection with the World's Columbian Exposition has hitherto not passed beyond that early stage common to most great undertakings during which discussion rather than action is the order of the day. Fortunately in this case the discussion has ended in the happiest possible manner and the way is now clear for action. The injudicious attempt which was made by a certain electrical paper to place a wrong construction on the attitude of the American Institute of Electrical Engineers toward the proposed Congress has totally failed of its object. The resolution passed by the Electrical Congress Committee and the Council of the Institute shows very clearly that that body has the true interests of the Congress at heart, and that it in no way wishes to pursue the high-handed policy that has been wrongly attributed to it. The motto of the World's Congress Auxiliary is "Not things, but men," and it has been fully recognized in Chicago that the Institute has among its members the men necessary to represent American electricians in the organization of the Congress. It has also been freely recognized that the Institute has during the past three years done some excellent pioneer work in connection with the Congress, that various of its members have gained valuable experience as delegates to past Congresses held abroad, and that, in short, its co-operation as a body in the preliminary organization is absolutely necessary to insure successful work in this direction. Professor Gray's visit to New York has resulted in this harmonious arrangement simply because such a meeting between the Institute and the World's Fair Committee was all that was necessary to clear up the situation. The misunderstandings that have arisen have simply been caused by outside interference entirely foreign either to the Chicago Committee or to the Institute.

* * *

Mr. Edison's Electric Railway. We reproduce this week from the London *Electrical Review* an article with the foregoing title in which Mr. Anthony Reckenzaun discusses what little concrete information has been published about Mr. Edison's new electric railway system. It is said that lookers-on see the most of the game, and it is certainly interesting to read what is said in England—where American progress in the applications of electricity is most keenly watched—of a scheme that has excited so much comment here. We understand that preparations are actively progressing for a practical trial of the system on one of the street railways in New York, and if this is brought to a successful issue it will certainly be the most important electrical event of the coming year. An actual public trial will do more to set at rest all doubts that have been hazarded as to the practicability of the system (on the strength of the dimly outlined descriptions that have been published) than all the newspaper talk that could be crowded into the Sunday issues of the entire daily press of New York. The cavils that have been expressed as to the danger of carrying such heavy currents through the rails in the streets have been answered by the statement that trucks and crowbars placed across the experimental tracks so as to short-circuit the generator have produced no untoward effects either on truck, crowbar, or generator. Crowbars are not generally found rolling about the streets, but trucks are usually drawn by horses, and no one has yet asked what would be the effect if a horse were placed in the same position as the crowbar was. A horse makes excellent contact and is known to be extremely sensitive to electric shocks. We question whether even so low a pressure as twenty volts would not sensibly stir the equine nature. Should Mr. Edison's new system come into general use, man's best servant will probably have to be provided with insulated shoes.

* * *

Criminal Economy. It is an absurd misuse of the English language to term the horrible catastrophe which occurred at Hastings on Christmas Eve an "accident." The system by which express trains are allowed to follow each other closely without the guidance and control of block signals simply invites such "accidents." The record of the New York Central shows this only too clearly; almost every one of the numerous fatal collisions that have disgraced its management during the past few years would have been prevented had the block signal system been in use. A company which boasts of owning "America's finest railroad" should have learned long before now that safety is a consideration at least equal to speed. An enormous amount of free advertising can doubtless be got by making exceptionally fast runs, and surely the extraordinary efforts that must be made to maintain a record-breaking express service on such a crowded line are amply repaid in this manner. But the equipment of the entire line with the block signal system would, we believe, prove a better advertisement even than the "Empire State Express." If the company can be induced to look at the matter in this light perhaps the work will be done; it would appear that the safety of their passengers is not a sufficiently important consideration to justify the necessary outlay.

* * *

The Telegraph Simplified. In this issue we print an interesting article by Lieut. F. Jarvis Patten on "Telegraph Systems" in which he gives a general sketch of the working of a large telegraph office and then proceeds to describe the operation of the various systems of Morse telegraphy in use to-day, from the simple single circuit up to the marvellous multiplexes, which make one wire do the work of six. To the average man the working of a duplex or quadruplex telegraph line is a mystery far beyond the grasp of the unscientific mind. He knows that in some remarkable way two or more messages are made to cross and pass each other on the same wire, but he has not the remotest idea as to how this is accomplished. Lieut. Patten explains the beautifully simple principle of the duplex, which by a simple process of evolution became the quadruplex, in the clearest possible manner, and to those who follow his descriptions and diagrams there can no longer be any mystery in this application of simple electrical laws to useful purposes. Coming to the yet more wonderful multiplex systems we find yet more remarkable results accomplished in an even simpler manner. By the bold operation of giving the line to each operator in succession for a fraction of a second, a single wire is made to carry the business of six circuits. It rather shakes one's belief in the enterprise of the management of the great telegraph companies in this country to know that this invention has been extensively adopted in England whereas it has hitherto not been recognized in America—the home of the inventor.

* * *

Decorative Electric Lighting. There is no better advertisement for the electric light than the beautiful decorative effects that are now obtained by its adoption in the lighting of public and private establishments where luxurious and artistic tastes are allowed to hold full sway. ELECTRICITY has illustrated and described many excellent examples of this feature of electrical installations. A few weeks ago the gorgeous illumination of the Holland House provided a theme for the pen and pencil of our able contributors and this week the unique effects obtained in a splendidly appointed retail store are touched upon in a manner that will interest all. The well known advantages which the incandescent lamp possesses over other illuminants are by no means the only ones which weigh in its favor with those enterprising individuals who cater to the luxurious tastes of the general public. The ease with which it may be adapted to any and every style of bracket, fixture, standard, lantern or other ornamental device render it available for the production of harmonious and artistic effects which it would be quite impossible to obtain with gas or oil. This artistic phase of the electric lamp is unquestionably the reason of its adoption in many cases

where otherwise it might be rejected and in this age of æsthetic and cultivated taste is bound to be an important factor in the rapid extension of electric lighting.

KIND WORDS FROM THE PIONEER ELECTRICAL JOURNAL.

A CHANGE OF PUBLICATION OFFICE.

We are pleased to welcome our active popular contemporary, ELECTRICITY, to its new metropolitan home. Although the original publication office was in Chicago, much of the work was necessarily done in the East, and the change is probably a wise one that will result in increased prosperity. New York is a much better distributing centre for a popular journal than any other city in the country, and there has long been a tendency for periodicals to gravitate toward it, werever they might originally start. The last number of ELECTRICITY was published here, and henceforward the Windy City will know its proof-readers no more, though is likely to retain a very active acquaintance with their finished products.—*The Electrical World.*

AMERICAN AND ENGLISH CENTRAL STATION METHODS.

The London *Electrician*, in reviewing Mr. H. A. Foster's little book on "Central Station Management and Finance," makes the following interesting comparison between American and English methods in the electric lighting business:

In England electric lighting supply companies have followed the lead of the gas companies; that is to say, they supply electrical energy at certain terminals in their customers' premises, but they are in noway concerned with anything that takes place beyond this point; that is to say, they have nothing to do with the wiring of the premises other than to test it, and to see that there is no serious leakage. They do not supply or maintain the glow lamps, and very few of the companies have anything to do with arc lamps. Such few arc lamps as are run off the great London stations are in every case the property of the customers themselves, and are maintained, carboned, and repaired by them, or, in some cases, by lamp makers, who take the trouble off their hands, and agree at a contract price to keep the lamps in order and to carbon them. In America the practice appears to differ widely from this. All the arc lamps and most of the incandescent lamps are contracted for at a price per annum; and the whole apparatus connected therewith is installed by the supplying company in the first instance, and is afterwards maintained by them. The American companies, therefore, have very complicated and multifarious duties to perform, and there is no doubt that for such a business a very complete organization of workshop and storekeeping accounts is absolutely necessary to commercial success.

THE WORLD'S ELECTRICAL CONGRESS.

Mr. Charles C. Bonney, President of the World's Congress Auxiliary of the World's Columbian Exposition of 1893, has appointed the following gentlemen members of the "Committee of the World's Congress Auxiliary on Electricity":

Prof. Elisha Gray, Ph.D., LL.D., *Chairman.*
Col. Robert C. Clowry, *Vice-Chairman.*

Prof. H. S. Carhart,	Mr. Enos M. Barton,
Mr. Frank S. Gorton,	Mr. E. B. Chandler,
Mr. C. H. Summers,	Mr. John P. Barrett,
Mr. F. W. Cushing,	Mr. W. A. Kreidler,
Mr. Charles H. Wilson,	Mr. George H. Bliss,
Mr. Bernard E. Sunny,	Mr. Herbert Laws Webb.

According to the brief prospectus issued by the World's Congress Auxiliary the electrical congress will deal with "scientific and technical electricity, telegraphy, telephony, electric light, electric power, and other forms of electrical application, with appropriate chapters and sections for the proper consideration of each."

Electricity is a division in the department of "Science and Philosophy," and a paragraph of the prospectus sets forth the scope of this department as follows:

"Each separate Congress will consider what are termed the living questions within its province. The responsibility of each committee will be limited to its own Congress. Each committee will be assisted by an Advisory Council composed of persons eminent in its particular field of action. The members of these Councils will be selected from various countries, and will act as Honorary and Corresponding members of the committees with which they are invited to co-operate. Meetings of scientists only will act on strictly scientific questions, while practical workers will actively participate in matters of applied science. The divisions and committees are intended to promote convenience of meeting. They are not published as technically accurate, either in name or limitation. The very great difficulties of making a satisfactory classification of the several sciences can be appreciated only by those who have patiently attempted the task. Provision for a particular congress means simply that it has been deemed proper to give it a place in the arrangements. * * * The final plans will await for a reasonable time the suggestions and advice of scientists and philosophers of all countries, whose views are cordially invited."

TELEGRAPH SYSTEMS. I.

BY LIEUT. F. JARVIS PATTEN.

There is very little about telegraph systems that can be styled popular. They have as a rule a forbidding appearance and a suggestion of intricacy that is more apparent than real. When the results that are accomplished are taken into consideration, however, the degree of simplicity to which the different systems have been brought is truly wonderful. In fact the ordinary Morse single circuit system is so exceedingly easy of comprehension that it is a proper cause for wonder that its discovery and application have scarcely seen a half a century of life while the modern improvements have been most prominent and rapid.

The expert who can "balance a quad" or plug a switchboard will find nothing that is new to him, and probably little that is interesting in this article, which is designed for the layman to whom "static charge" and rheostats are mysteries unfathomable and forbidding at first glance.

It is my purpose only to explain the broad characteristics of the different systems of telegraphy that have come into modern use and make their general features plain to those who would like to have a general notion of them.

I remember when a cadet at West Point, in what was styled the "Phil" course (Physics and Astronomy), there was a critical point which, safely passed, the cadet had reasonable expectations of wearing shoulder straps some day. This critical point in the course was known as the problem of the "artificial sun," and was the means of landing many an embryo general somewhere below the bottom of his class and ending further aspirations to fame as a patriot militant. I have forgotten much about that "artificial sun," which, as I recall it now, was a sort of fictitious luminary that we had to imagine into existence as the only means of determining the place where the real sun was to be found, notwithstanding the fact that the latter was at the time plainly visible to the naked eye.

Years later, when at work in telegraphy, I found that I had to make use of an "artificial telegraph line" in order to give the actual line, so to speak, existence and reality, and I was here again forced to the conclusion that fictions are sometimes real, however imaginary they may appear. This fiction, which is an actual necessity to all duplex and quadruplex systems, was for years the habitat of "bugs" that bothered the minds of the most acute investigators and the capture of which was their crowning victory. It may be well to explain here that a "bug" in telegraphy is the name given to any unknown or unexplainable perplexing hitch that prevents a system from working as it should. It may be well imagined that this sort of "bug hunting" has little sport in it for those compelled to engage in the search and capture.

There is something about the appearance of a great telegraph office that suggests to the stranger much that is mysterious and complex, the maze of wires and keys and magnets, and the many odd-looking instruments and boxes about suggest at first a ready excuse for temporary insanity. This impression, however, is not in accordance with the facts, and appearances are perhaps more deceptive here than elsewhere.

Let us go into a large main office and look about for a few moments before beginning to investigate the various appliances and systems in use. On every hand are tables attended by busy operators who are either working at or watching the different instruments and machines that seem to be talking to the persons silently contemplating them, while a continuous hum of click, click, click, which seems at first distracting, is not unpleasant to the experienced ear.

On one side of the room is a large board structure covered with brass straps punched with hundreds of holes, while as many brass plugs are at hand for filling them up, and men are changing the pegs about from one hole to another at irregular intervals much as if they were amusing themselves at a game of checkers. This piece of mystery is the switchboard, and it is nothing more or less than the collected ends of all the wires that come into the building, here conveniently arranged so that by inserting a plug in a hole one wire is connected to another. Thus by inserting a plug in a certain hole a main wire, say, from Philadelphia, is for the time being connected to the wire that runs to Jones' office in Wall Street.

In another direction other men, shut up in separate compartments, are pounding away at harmless looking boxes with every indication of dire vengeance; they have a small club in each hand with which they strike movable knobs upon the boxes. These are Wheatstone operators and they are working a machine punch which perforates a long paper ribbon with holes which stand for letters and words.

Yards of this tape containing many messages and hundreds of words are perforated in this way and then given to another operator who places it in another machine and, swish! in about the time it takes to write the word the marks upon the tape are reproduced upon a similar paper ribbon in Chicago.

It is history, whether true or false, that the first message sent over the first line were the words "What hath God wrought?" Could Professor Morse have seen the Wheatstone automatic sending its hundreds of words in a few seconds nearly a thousand miles away he might be pardoned for exclaiming in the vernacular of the day—"What hath the devil wrought now?"

It must be remembered, however, that although on this system the message goes over the line in a few seconds it has taken considerable time to prepare it for sending, and arrives at the other end in the unintelligible modern Greek of dots and dashes, thus requiring another handling there before the person to whom the message has been sent can read it. This brings us perhaps to the reason why this automatic system, capable of so high a rate of transmission, has not altogether superseded most systems in general use.

Other systems possess features even more remarkable, and each is used upon the line to which it is best adapted.

At other tables are seen the quadruplex sets where are found at work the most skilled operators of the service. They are working the principal wires to large cities, many of which are worked as duplexes and quadruplexes, the particular features of which deserve special consideration.

Nothing can be easier to comprehend than the ordinary Morse telegraph, which it will be presumed is familiar to even the uninitiated. It is interesting to note, however, that some of its most pronounced steps toward perfection have been the result merely of accident and practice. As an illustration of this, the receiving sounder, called by the French the "parleur" or talker, was not in use thirty years ago, and, so to speak, invented itself. At that time messages were reeled off on a paper ribbon, dots and dashes being indented in the paper by a costly and complicated machine. After long use the expert operator became so accustomed to the sound that he found himself reading by ear and paying no attention whatever to the tape, and in country offices he would be found selling groceries at the counter while listening to the instrument in a distant corner and taking the message by ear. Thus a costly machine was displaced by a simple magnet and armature which talks to the operator in a language as plain to him as his mother tongue.

Want of space will forbid consideration of the simple Morse system and we will pass at once to the so called multiplexes. In plain words, any system which admits of sending two or more messages at the same time over the same wire is a multiplex. They are known as duplexes, quadruplexes and multiplexes proper, by which latter more than four messages are simultaneously transmitted over the same wire without interference.

I shall not readily forget how mystifying it seemed when first explained, the Edison "quad" the marvel of the early seventies. This system transmits four messages, and my informant made it plain to me that the "wizard" somehow divided the wire up longitudinally into quarter sections and that the currents of the different messages were somehow persuaded to abide each in its own particular quarter of the wire. This explanation, I fear, is often given and accepted to-day.

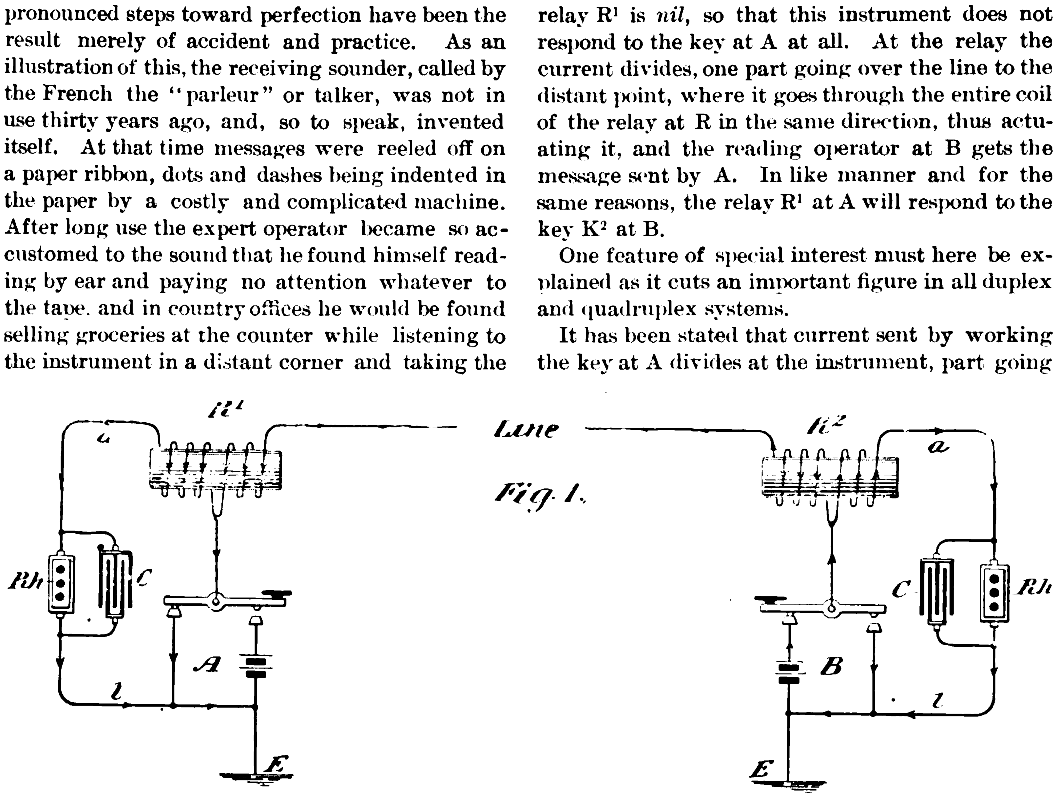
The duplex and quadruplex are really difficult to explain to those unfamiliar with electrical science and the attempt to do so will be confined to the general features of these systems. The multiplexes proper are much easier to explain being based upon principles more readily comprehended.

The "duplex" was first made practical early in the fifties and there is now an astonishing variety of ways in which the thing can be done; all, however, based upon similar underlying principles. Fig. 1 shows a diagram of the circuits of a differential duplex, by which two operators at the opposite ends of a line may send to each other at the same time without interference. It consists of a similar arrangement of circuits at the two ends so contrived that the receiving instruments at either end are not affected by the currents sent to the line by the home operator's key, but they are responsive to currents coming from the distant end. Thus, one operator at A may be sending to B while at the same time another operator is reading the instrument R^1 at A, which is clicking off the message sent by a second operator at "B."

The manner of operation will be understood from the diagram. Thus when the operator at A depresses the key K,[1] connecting the battery B^1 to line, the current goes to the relay R,[1] where it divides and half going round its magnet one way and half in the other direction, the effect on the relay R^1 is *nil*, so that this instrument does not respond to the key at A at all. At the relay the current divides, one part going over the line to the distant point, where it goes through the entire coil of the relay at R in the same direction, thus actuating it, and the reading operator at B gets the message sent by A. In like manner and for the same reasons, the relay R^1 at A will respond to the key K^2 at B.

One feature of special interest must here be explained as it cuts an important figure in all duplex and quadruplex systems.

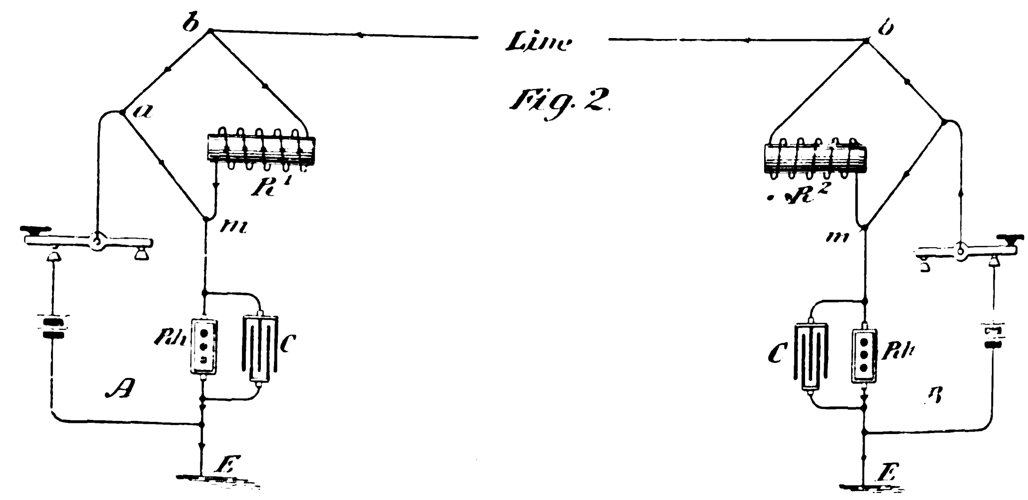
It has been stated that current sent by working the key at A divides at the instrument, part going over the line and part to earth by a, Rh, l, and this roundabout way, which looks like getting there backwards, is what is known as the "artificial line." It is so called because it must resemble the actual line and have the same conditions as far as possible. Thus the rheostat Rh, consists of a lot of coils of fine wire that can be made to equal the line in resistance, while the condenser, "C," provides an electrical discharge similar and opposite to that of the actual line. It is manifest that this "artificial line" must resemble the actual line very closely, otherwise the currents in the two halves of the relay "R" would not be equal and opposite and so annul each other, but would work it and interfere with the signals sent from the other end, of which alone it must take cognizance. The adjustment of this equality of conditions between the actual and artificial lines is called "balancing," and balancing a quad is a delicate undertaking.



Differential Duplex—Diagram of Connections.

Other duplexes, which we will not describe in detail here, are the "Bridge" and the "Polar" duplexes which are equally ingenious and effective. The former is shown in Fig. 2.

In this system the current sent to line by the key at A divides at the point a, from which it finds two paths to earth, one over the line and the other by way of the artificial line a, m, Rh, but neither of these currents can get to the receiving instrument, R^1 placed in the so called "bridge" b, m. But currents coming from the distant end divide at the point b, one part going through the relay R^1 to earth, thus causing it to sound the message from the distant end.



"Bridge" Duplex—Diagram of Connections.

In the polar duplex a polarized receiving relay is used which can be given such an adjustment that it will only respond to the positive currents which are sent from the distant end, while only negative currents are sent at the near end and to which the instruments at the distant end are adjusted to respond.

Such are the principal duplex systems.

The quadruplex systems are somewhat more complex, but are easily mastered if the duplex systems are well understood, as the quadruplex is nothing more than a double duplex.

The one in common use to-day consists of a combination of a polar duplex, which is known as "the polar side of the quad," and another sort of duplex that is worked by currents of different strength and known as the "plain side of the quad." Both are connected to the same line wire, and as each of the duplexes admits of sending and receiving a message at the same time, there may evidently be four messages upon the wire in this system, *i. e.*, two going and two coming. It is well to note here, however, that all four cannot be going in the same direction, but two each way. This marks the limit of the so called "differential systems" or balanced methods.

An explanation of the quadruplex in detail would hardly be suitable for an article of this length, and we will now pass on to the multiplexes proper, which are really beautiful in their extreme simplicity, while yet they are marvels of invention. These systems, of which there are only two that have received any development, the Delaney and the Patten, have not yet come into general use in this country, but are used to a considerable extent in England.

In these systems, which depend upon entirely different principles for their operation, more than four messages can be maintained upon the same wire, ordinarily six or eight, and even twelve on short lines. They may be all going or all coming, or divided in any desirable way, passing each other in what would appear to be inextricable confusion, but each going to its proper destination at the distant end.

CHICAGO ELECTRICAL ASSOCIATION.

At the last regular meeting of the Chicago Electrical Association, held December 22, the following officers were elected: E. G. Hovey, President, F. McBerty, Secretary, and Albert Scheible, Treasurer. With this meeting the Society closed its first year as an organization. The work that has been done by the members has been highly satisfactory to all attending the meetings. He

association is composed of young men, most of whom have received the benefits of a college education and are engaged with the electrical supply and manufacturing companies of Chicago. The membership, although small at first, has increased so rapidly that the society will soon be obliged to seek larger quarters. The object of the association is to bring young men engaged in electrical pursuits together for the reading of papers and discussion of subjects pertaining to their business.

GRANULATED IRON CORES.

It will be remembered that in a previous issue of ELECTRICITY we commented on a note published in the London *Electrical Engineer* which implied that Mr. Currie proposed to do away with Foucault currents in the armatures of dynamos and motors by the use of cores made up of iron filings. Our comments, which, of course, were entirely unfavorable, were reproduced and endorsed by the London *Electrical Review*, the latest issue of which contains the following explanatory letter:

From a reference in your last issue I notice, through the medium of an American journal, that I have been credited—or discredited I should say—with proposing the use of cores for dynamos and motors constructed of a mass of iron filings. I presume this mistake has originated from the fact of my having lately taken out two patents for the construction of such cores for various forms of measuring instruments. In certain forms of ammeters and voltmeters I have applied cores of iron filings mixed with a binding substance and found such had many advantages, one being their adaptability to direct as well as alternating currents. Also in case of electric meters constructed on the motor principle, I have used them with advantage. Also in some instruments, where solenoids and small electro-magnets are used, I have substituted these cores in the place of ordinary solid ones. The idea of applying such to motors and dynamos generally is one for which I must confess I am not responsible. In the case of small instruments as described the principle may be applied with advantage, and it is to such only that the patents refer.

S. C. C. CURRIE.

December 5th, 1891.

We print Mr. Currie's explanation with great pleasure, but would point out that it was originally through the medium of an English journal that he was credited with the proposition that he disclaims.

THE STORY OF A TREE.

Le Monde des Plantes is responsible for the following extraordinary story which purports to be a statement of facts. About two years ago, at the end of the month of September, a large tamarind tree was struck by lightning at Kumbakonam, in India, and fifteen days afterwards the tree burst into bloom; but whilst every branch was laden with blossom not a leaf was to be seen. When the time came for its normal flowering, the tree developed a second crop of blossom, and then, as though exhausted with the strain, it died. We think it is scarcely allowable, says the London *Electrical Review*, for our contemporary to argue from this isolated instance that the electricity had produced a sort of super-excited vitality. If such phenomena had been observed in a large number of similar instances, then some deductions might be attempted. As it is, the isolated fact proves nothing, and may be merely a remarkable coincidence, or an example of abnormal behavior. Even though the tree had not been struck by lightning, an accident which we should have thought would have decreased its vitality, it might still have experienced this kind of abnormal flowering. How would our contemporary explain the following facts? The white hawthorn flowers in May, yet the Glastonbury thorn produces May-blossoms, almost unaccompanied by leaves, at Christmas time, and then flowers again in May.

MR. EDISON'S ELECTRIC RAILWAY.*

BY A. RECKENZAUN.

About a month ago Mr. Thomas A. Edison was interviewed by a reporter of the New York *Herald* on the subject of a plan for the development of electric railways. Anything that comes from Mr. Edison receives public attention. The daily press took the matter up as a wonderful discovery. Telegrams were sent to all parts of the globe announcing the important fact, and the powerful president of the Edison General Electric Company, Mr. Henry Villard, was reported to back the new scheme to any extent, even to the working of big railroads electrically.

Little or no notice would have been taken by the press or the public had any one else made suggestions similar to those imputed to Mr. Edison in the New York *Herald* of October 25, 1891. Experts, and even amateurs, would have smiled at the idea, which, in principle, is as old as the oldest electric motor. No sooner was the electric motor invented, and we may go back 50 years and more for that, than the suggestion was made to use the rails upon which electric cars were to be run as the medium for conveying the energy to the propelling apparatus. Messrs. Siemens and Halske, of Berlin, worked a practical line on this plan 12 years ago, and Mr. Volk's little railway at Brighton is still in operation as an example of what can be done with electricity in moving cars with the current supplied through the rails.

In these and other similar cases tensions of over 100 volts are employed, and though the rails are fairly well insulated from each other by creosoted wood sleepers, the leakage in wet weather is considerable. Any traffic across the tracks is carefully avoided, and no one with sufficient experience has hitherto had the courage of publicly announcing that the electric currents may safely be sent through both rails of a tramway in populated highways with the object of propelling electric cars along streets where every other kind of traffic is carried on, such rails being exposed, and continuously in electric contact with the source of supply. Mr. Edison is satisfied that the thing can be done economically; he has experimented, has obtained certain data, and he is going to equip a line in the vicinity of New York City at an early date. Twenty volts is the maximum tension to be used, and with this low voltage neither beast nor man can be injured, or even feel the presence of the electric current.

The first questions which an electrician will ask are: How is Mr. Edison going to prevent leakage to earth and across the rails having a difference of potential of 20 volts, especially in wet weather? How is he going to prevent metallic parts of other vehicles taking the current, or even short-circuiting the whole arrangement? The tramway engineer at once enquires: How are the rails to be tied? Any materials other than stiff metals cannot be relied upon to hold the rails permanently in position. To all these questions Mr. Edison will give answers as soon as detail patents are obtained in every country. Some he has already answered in the presence of a representative of the New York *Electrical Engineer*.

Anyone might assume that carriages with iron wheels passing over the tracks would short-circuit the line and cause the destruction of the dynamo machines, as well as damage the short-circuited vehicle. To test this, Mr. Edison is said to have actually "short-circuited his experimental track with a carriage having iron wheels, and succeeded in getting only 200 amperes through the wheels, the low voltage used, as well as the insulating properties of the axle-grease, being sufficient to account for the small quantity of current which actually passed through." Another experiment was made by "short-circuiting the track with an iron bar. As a result, it was found that with the iron bar polished, and contact effected by a man standing upon the bar, only 1,000 amperes passed through it; that is' the amount which would be taken by a single car, and hence far below the capacity of the generators." Nothing is said about the shape or dimensions of the bar. Probably a flat bar was placed upon rails with curved tops, which would give a small contact area; but the wonder is that in this case the bar was not welded to the rails, taking it for granted that the generator was capable of giving a larger current than 1,000 amperes. I can only explain the limited flow of current in these cases to the small contact between the bar and rails, due to curvatures.

Doubtful as these results seem to be, the experiments of Mr. Edison on the leakage between rails are decidedly interesting, and, apparently, more conclusive. He is said to have proved that "at a potential difference of 20 volts the loss of current due to leakage between the rails under the worst conditions, with a wet and salted track, is only 5 H. P. per mile, while very wet weather would involve a loss of only 2.5 H. P. per mile." A heavy rain will reduce the leakage between the rails by washing away the accumulations between the tracks, due to the droppings of horses, which serve largely to increase the conductivity of mud. In dry weather the loss is necessarily smaller. Taking it for granted that the rails are partially insulated from earth, and that the maximum loss is 200 amperes per mile, due to the worst dampness in the road, and that we have four cars to the mile, this leakage would amount to about 50 amperes per car. The average power used by a full sized loaded tramcar on an ordinary road should not exceed 10 electrical H. P., but a maximum of 30 H. P. must be provided for at the generating station. The average current per car will therefore amount to 373 amperes. The loss under the worst conditions of roadway, with an interval of barely two minutes between the succeeding cars would therefore be $\frac{50 \times 100}{373} = 13.4$ per cent., which does not seem excessive. What the loss will be through wheel tires and brake gear of other vehicles, setting aside iron wheels and short circuiting bars, cannot well be ascertained; but one feels inclined to think that at odd times it may be enormous.

It is not stated how Mr. Edison is going to send the current from the generating station to the cars. The rails themselves, even if made heavy, say 100 lbs. to the yard, giving a section of about 10 square inches, should not carry more current than sufficient for two cars; therefore he must have either copper feeders of very large section, or motor generators stationed at intervals along the line. As regards first cost, there will be little to choose between heavy copper rods on the one hand, or a large number of motor generators on the other; for, in any case, the system, assuming it practicable, can only be applied to roads with a very large traffic, otherwise the necessary loss per mile would form too great a percentage of the power used for propulsion.

Mr. Edison estimates the cost between £6,000 and £20,000 per mile of double track, not including the cost of stations, and depending between these limits upon the amount of traffic. The running expenses he estimates will be exactly the same as with the overhead wire system. These figures are considered to compare favorably with cable roads, which, without stations, are said to involve an expenditure of between £30,000 and £60,000 per mile.

It is quite out of the question that Mr. Edison can use existing tracks without pulling them up, for the purpose of removing the metal tie rods and replacing them by insulated ones; the road must also be disturbed for the important purpose of thoroughly connecting the rails with the feeders.

If this system should come into use for tramways, and I see no advantage in low-tension working for the big railways, it will possibly evolve a

*Electrical Review, London.

new thief or electro-kleptomaniac. The temptation will be there on account of the ease with which one could draw energy from the rails, to be stored up if desirable in secondary batteries, carried by a trap going over the charged rails, picking up current all the while.

All sorts of possibilities come into one's mind; one is that the rails themselves and connections with other metals will form a kind of semi-dry storage battery, consisting of electrodes of large surface. What will become of one or the other of these electrodes after a while, with unlimited local action, is difficult to realize.

The advantage which Mr. Edison's system has, or might have, is the absence of overhead conductors. An incidental advantage to this system, apart from having no overhead lines, would come out at night and foggy days. The cry is "More light." By Mr. Edison's method we see this provided. The vehicular traffic would not be the quiet prosy thing of the present, but would be one brilliant scintillation of flashes and sparks, to say nothing about the occasional welding of an entire coal wagon, for example. The current coming up the wheels into the loaded wagon, setting up numerous arcs between oscillating carbons, would be a grand sight, and put pyrotechnics of the past into the shade.

TELEGRAPHIC ABBREVIATIONS.

It will be remembered that in the article contributed to a recent number of Electricity by Mr. S. J. Pryor on the use of the typewriter in telegraphy, mention was made of the assistance rendered in increasing the speed of working by the Phillips' code of abbreviations. The London *Electrical Review* mentions that a system of code of abbreviated messages was decided upon by the London and North Western Railway telegraph department in 1884. The result generally has been eminently satisfactory, and now after seven years' working experience, the system is so favorably looked upon that the list of codes has been considerably enlarged, over 700 sentences and phrases being added to the original list. In 1889 (with the old list in use), when some particulars were taken, it was found that at *one* station alone, the adoption of the code saved the signalling of over 5,000 words in *one day*, which, taking the extensive railway system into account, means a considerable saving in the way of wires and operators. The code starts with N and goes to Z, then N A to Z A, to N B to Z B, etc., to Z Z; and with three letter codes, N A A to Z A A, N B A to Z B A, N C A to Z C A, etc., etc. Some objections were at first raised on the ground of liability to error owing to the codes being formed of meaningless letters and not in the form of a complete word which the telegraph operator could understand, but these objections were found to be baseless, and it is stated that there are no more errors than with messages written out in full. In 1889, when an examination was made, it was found that fully 75 per cent. of the messages sent over the wires were abbreviated. Several of the large railway companies in Europe have adopted the system.

THE ELECTRIC LIGHT AND POWER PLANT AT THE WORLD'S FAIR.

Reference has frequently been made to the mammoth electrical installation that will be required to supply light and power to the different buildings of the World's Fair, and to light the exposition grounds. Within a few weeks Chief Burnham will call for bids for all the electric lighting plants at Jackson Park. Specifications are now being prepared for the system. Mr. Frederick Sargent, electrical engineer to the World's Fair corporation, in speaking to a newspaper reporter, gave the following glowing account of the proposed electric lighting work: "When the plant is completed at Jackson Park we shall have more than twice as many electric lights on the ground as are now used in the city of Chicago for all purposes. It will be by all odds the largest plant in the world. We shall have 7,000 electric horse power for arc lights, 12,000 horse power for incandescent lights, and 3,000 horse power for all the different kinds of motors that exhibitors expect to install. The buildings and grounds will literally be lighter than day when all the lights are turned on. In letting the contracts for these plants we have divided them so that all firms, no matter how small by comparison with the larger ones, can have a chance to bid. In all there will be about fifty contracts. Arc and incandescent lamps are to be used in each of the fourteen big buildings. The ground will be divided into sections so that everybody can have a chance to bid."

THE TELEGRAPH IN GERMANY.

At the end of March, 1891, there were 11,448 telegraph offices in the German Empire, as against 9,408 at the end of March 1888. The length of the lines above ground in March 1888 was 48,070 miles as against 57,791 in March this year. Of underground lines there were in March last 3,631 miles, showing an increase of 131 miles in the above mentioned period. There was also a further 1863 miles of submarine cables belonging to the government. In the year 1889 no less than 24,864,066 messages were transmitted, as against 22,157,267 in 1888, or an increase of 2,706,799 messages.

MOLECULAR CHANGES IN A RAZOR.

A writer in *Cassiers' Magazine* relates the following interesting little story, which goes to show that in scientific minds the desire to explain seemingly mysterious phenomena in a scientific manner sometimes leads to overlooking the true cause, which may be a very simple one: "The molecular changes in metals when their temperature is raised or lowered has been an interesting topic for many years, and while I have had no practical experience to give scientific data regarding the matter, I did have an actual opportunity to discover what I supposed for a time would prove a very valuable contribution to literature on the subject. Like many people who possess a razor, I had one which for years had been a very satisfactory tool by which to remove the hirsutical growth. It was the pride of my heart, and I could not compute its value in dollars and cents. Any ordinary amount would not have purchased that razor. In fact, I had often told my friends that one million dollars would not tempt me. But alas to hopes and expectations! A molecular change made my razor a worthless piece of steel, with which a sharpened farmer's hoe would have been ashamed to compete.

"Last June I arrived in Providence on the second day of the convention of the American Society of Mechanical Engineers. Every room was taken, but I managed to obtain a cot in a room with a man who, I must say, was not an engineer. The room was small, and the dressing-table was covered with an assortment of combs, brushes and toilet requisites. The day I arrived the temperature was about 100 in the shade. I used my razor. It worked perfectly. The next day, it will be remembered by those who were present, was decidedly cooler. It dropped 30 degrees. I found it necessary to use my razor (unfortunately, every twenty-four hours I have to), and after putting it through the usual application on the strop, rubbing it on my bare arm and getting it in prime condition, I started to shave. I rubbed it with the 'grain' of the hair, and I rubbed it against the 'grain,' but not a hair moved. I stropped it again, but I could make no impression on my beard. Now, said I, here is an actual fact regarding the molecular change in metals, and as that was one of the topical questions at the meeting, I said to myself that I would bring the razor to the hall and give the full facts to the members there assembled. I went out to dinner, and when I returned started to get my razor. I could not find it. I hunted high and low but the razor had disappeared. The hall-boy crawled under the bed, and looked in the fireplace, but no razor appeared. I rang for the chambermaid. 'The razor?' she asked. 'Why, yes; the man who had used it sharpening his lead pencils in the morning took it while I was making up the room.'"

A CURIOUS UNDERGROUND WIRE ACCIDENT.

A German paper cites the following instance of interference between electric light and telegraph cables:—The dangers attendant on electric lighting have been shown lately in Berlin. An electric cable and a telegraph cable repeatedly cross one another. In such places the telegraph cable is laid in an iron pipe which for the sake of extra protection is made 1¼ cm. thicker. In one place in the lighting cable which had become damaged, the electric current in the lighting main melted its own cable, and also the iron protecting tube of the telegraph cable. The molten liquid finally succeeded in destroying the telegraph cable, which could no longer be kept in use.

A PROTEST.

We have received the following letter from Mr. Wm. Hood, the well-known manufacturer of the "Jewel" incandescent lamp, who rightfully protests against the piracy of his trade-mark by a newly incorporated company:

Chicago, Dec. 24th, 1891.

To the Editor of Electricity:

Sir—

In looking over the list of new incorporations in a recent issue of the Chicago *Evening Post*, I noticed that certain parties, wholly unauthorized by me, have made application to the Secretary of State for the incorporation of a company for the manufacture of incandescent lamps. This company states that it is to be known as the "Jewel Incandescent Lamp Company."

The purpose of these parties, whoever they may be, is evidently to appropriate the name "Jewel" as applied to incandescent electric lamps; and for the purpose of defrauding me of my trade-mark, which I have extensively advertised and introduced, and which name has become very valuable.

The name or trade-mark "Jewel" as applied to incandescent lamps, originated with me, and is my personal property. Any attempts by other parties to pirate this name, is not only an injustice to me, but to users of the "Jewel" Incandescent Lamp.

By kindly giving this publication in your valuable paper, you will greatly oblige,

Yours very truly,

Wm. Hood.

NEW TYPES OF MATHER MOTORS AND GENERATORS.

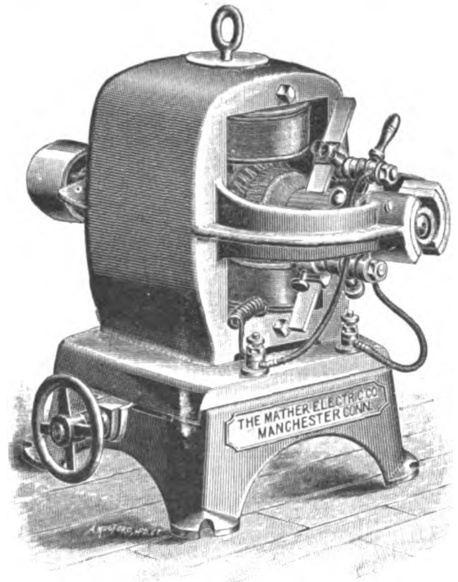
To meet the increasing demand for motors and generators for the electric transmission of power current, the Mather Electric Co., of Manchester, Conn., has designed some new types of electric motors and generators. As will be seen from the illustrations the essential features of the well-known ring type are incorporated in these machines, and this, with the addition of the new features, enables them to be the more readily and completely insulated against the high potentials required for power service. One of the essential features of the old type was a field-magnet having the form approximately of the magnetic lines of force and consisting of one piece. In the new type the cores of the field-magnet are straight, permitting the use of coils of wire that can be wound separately on a machine, while the rest of the magnetic circuit is practically a ring; the whole, including the cores and pole pieces, is cast in one piece without a joint.

The new type of motor is built of 1, 3, 6, and 10 horse-power with two poles; and 20, 30 and 40 horse-power with four poles; the accompanying cut conveys a good idea of the motor of the two pole type. This type is well adapted for motors ranging up to 10 H. P. capacity. The company keeps in stock some of these motors that are wound

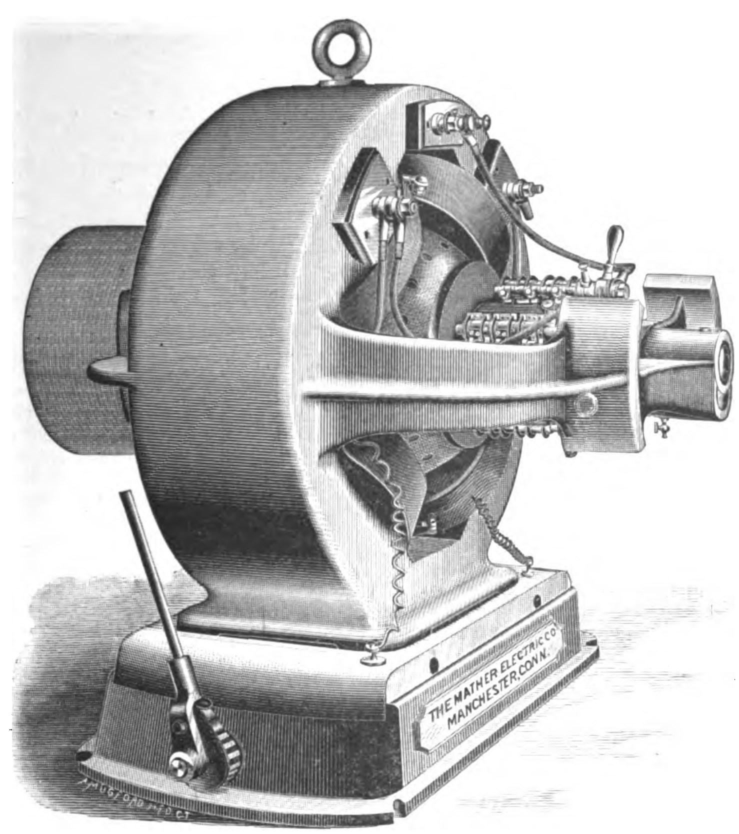
for 220 volts, but wind them when ordered for 110 or 500 volts. The principle of winding is such that in no case is there a loss of more than 4 per cent., the speeds varying from 1500 revolutions for the 10 H. P., to 2500 for 1 H. P., the variation in speed from full load to no load never being more than 4 per cent.

The generators, shown in the larger cut, are built of 30,000, 50,000 and 75,000 watts with four poles, and 180,000 watts with six poles. Drum armatures are used in all these machines. In the four pole machines the winding is such that the current has but two paths through the armature wires, and by a special method devised by Prof. Anthony, no two wires between which there is any great difference of potential are brought near each other. The cut shows clearly the field magnet in one casting. In the 180,000 Watt six pole machine, the field-magnet is cast in two halves, but is divided through the middle of two opposite poles instead of across the magnetic circuit.

So efficient has this type of generator proved to be that the Mather Company is now building one of about 120,000 watts, which will be of the four pole type and will embody the same general principles as those mentioned for other sizes of machines. In designing these generators what was aimed at specially was perfect electrical balance and absolute freedom from sparking at the commutators under variation of load. This result, it is claimed, has been attained to a degree not approached by any other manufacturers. In part this is due to using very powerful magnets, consequently few turns on the armature, but also in part to the form of the field-magnets, which allow of a gradual passage of the coils into and out of the magnetic field.



MATHER MOTOR, FIG. 1.

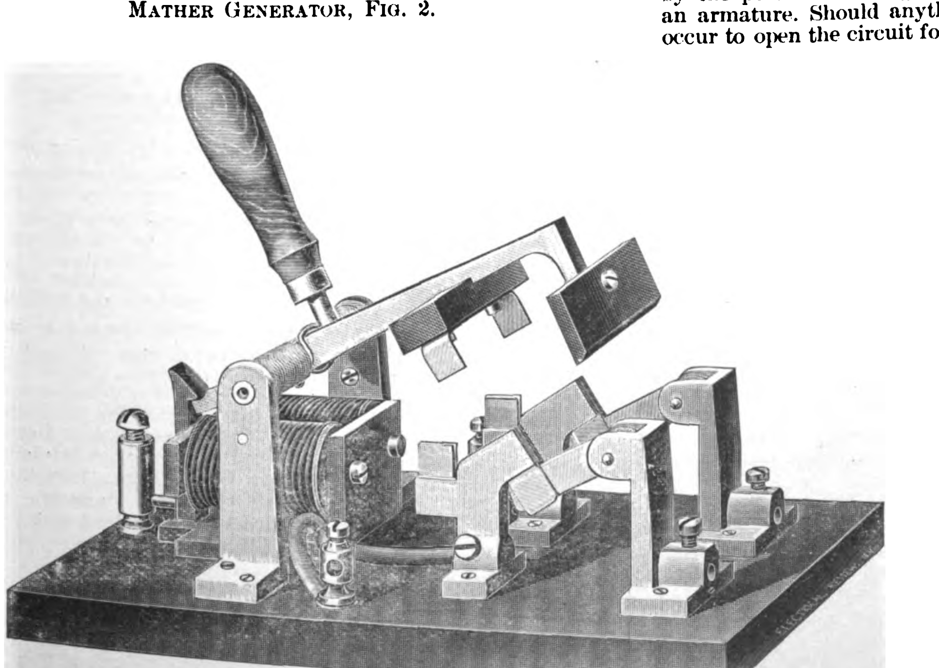


MATHER GENERATOR, FIG. 2.

HILL'S SELF - ACTING SWITCH FOR CHARGING STORAGE BATTERIES FROM ARC CIRCUITS.

The switch shown in the illustration was designed by Mr. W. S. Hill, to be used when charging storage batteries from arc lighting circuits, to prevent the circuit from being opened and the streets being left in darkness in the event of any accident happening to the batteries or to any of the connections, resulting in a local interruption of the circuit.

The switch has four contacts, an electro-magnet, and a lever actuated by a spring. When the lever is raised (as shown in the cut), the magnet, the four contacts and the batteries to be charged are all connected in series between the two binding posts. The latch that keeps the lever up is held in place by the pull of the magnet on an armature. Should anything occur to open the circuit for an instant, the magnet will be demagnetized, allowing the latch to be drawn back by a spring, thus releasing the lever. The lever then drops, closing the circuit between the two line contacts, thereby restoring the main circuit. At the same time the connection between the main and the battery contacts is broken, both ends of the battery circuit being disconnected, preventing its being short circuited on itself. With slight modification the same device can be used to cut out the batteries when they have been sufficiently charged. In this case the position of the magnet is reversed, and it is made to release the latch when a predetermined amount of current is passing through it, the magnet being connected in shunt with the batteries instead of in series. These switches are manufactured by the W. S. Hill Elec. Co., No. 54 Devonshire Street, Boston, Mass.



HILL'S SELF-ACTING STORAGE BATTERY SWITCH.

A company has been formed in Berlin to be known as the Deutsche Aluminium Akkumulatoren Werke für Elektrische Beleuchtung und Kraftübertragung, to exploit an aluminium accumulator.

FROM NEWS CENTRES.

BOSTON.

BOSTON, Dec. 26.—An electric railway project is under way at Cottage City, the favorite resort in southern Massachusetts. It is proposed to connect Cottage City with Gay Head, by constructing a railway through Tisbury and Chilwark. Should this project be consummated it is likely to give the district an immense boom.

Indications warrant the belief that ere long the flourishing cities of Lowell, Lawrence and Haverhill will be connected by an electric railway.

The West End Railway Co. is to have 175 more electric cars running before Feb. 1, so great is the increase of traffic on the electric sections of its system. The new cars will all be equipped with noiseless motors.

The movement set on foot a few weeks ago for the organization of a New England Electric Club took definite form on Wednesday evening last, when a large meeting of prospective members was held at the Tremont House to elect officers and settle other preliminaries. Mr. E. P. Morris, of the Thomson-Houston Electric Co., was called on to preside. In a neat speech that gentleman outlined the work which had been done and what remained to be done to ensure the founding of such an institution as was contemplated. A motion to at once organize was then put and carried, after which Mr. Ferdinand A. Wiman, in favoring the scheme, expressed his belief that during the next three years there would be an immense increase in the growth and development of the electrical business in all its branches. Messrs C. C. Pierce, S. B. Jenkins and E. P. Morris also spoke very favorably of the undertaking. The following officers were elected: President, F. A. Wiman, Vice-President, E. A. Record, Secretary, L. M. Hays, Treasurer, A. O. Smith, board of directors, C. C. Pierce, M. W. Brown and E. P. Morris. It augurs well for the success of this club that no less than 110 gentlemen have signified their intention of becoming charter members.

Not many electrical visitors to Boston will be likely to omit calling to inspect the handsome show room and artistic stock of electroliers now carried by the Consolidated Electric Manufacturing Co., Franklin and Congress streets.

Mr. J. P. Cushing, Knapp St., Boston, is at work on a set of testing apparatus for the city fire alarm department, to be used by Captain B. S. Flanders for testing all kinds of electrical devices before they are adopted or used by the city. The apparatus has been designed in part by Captain Flanders himself. W. S. K.

NEW YORK.

The chief topic of discussion at the last meeting of the Board of Estimates and Apportionment was the item of $175,000 inserted for a new telegraph service. All of the Commissioners agreed that the present system is antiquated and inadequate. In this opinion the Board coincided, but as no definite plan had been devised, the item was not allowed. The Board of Police wanted $75,000 for a new telegraph system between the stations. The old dial system in use at present is inaccurate and slow. The Board of Police desires to adopt some system of the Stock Exchange ticker order, so that a record can be kept of the messages sent and received. The item of $100,000 was put in to establish a system of signalling between the patrolmen and the station houses. The item was cut out and will not be allowed until a definite system has been brought before the Board. This appears to be

an excellent opportunity for the exploitation of a good system of electric signalling. It is not generally known that for some time an appropriation of $100,000 has been waiting (and is still untouched) for the appearance of a system of signalling suited to the requirements of the Board of Police.

An important event in the history of Brooklyn has taken place during the week. The Board of Aldermen of that city have granted by a vote of 13 to 4, to the Brooklyn City, the Coney Island and Brooklyn, the Brooklyn and Newtown and the Atlantic Avenue street car companies permission to run their 200 miles of lines with the trolley electric system. The only restriction placed on the companies were that the poles must be of iron or steel, at least twenty feet high and erected on the curb line, and that the speed must not exceed ten miles an hour. Wires can be strung along the "L" road structures where permission can be secured. Each company must give a bond for $150,000 to indemnify the city for any property damaged. When the railway company reported the ordinance to the Board of Aldermen its opponents protested against its passage on the ground of danger to the people. The weight of this quibble has been very acurately gauged on several occasions and the Aldermen seemed to know just what it was worth, by the fact that it had not the least influence with them. The opponents of the bill were allowed to talk themselves out, and then the measure was passed, quite in a matter of fact way. Although it has been openly charged that a large corporation fund had been raised to pass the bill, no notice was taken of the charge during the meeting.

It is understood that the action of the Aldermen on the trolley application will mean the expenditure of $12,000,000 during the next two years. The street railway companies are determined to lose no time now that their way is clear. President Lewis of the Brooklyn City Road intends to begin work at once, and will erect a plant at Second Avenue and Fifth Street, with a 1,600 H. P. engine. By Decoration Day he expects to have the Third Avenue dummy line and the Hamilton Avenue line operated by the trolley system. The next thing will be the erection of a power station at Fifty-second Street, with 5,000 horse power. This will supply the Third Avenue, Court Street, and Furman Street Roads, and probably the Flatbush Avenue and Fulton Street lines. Another power station for the other roads will be erected near Fulton Ferry. Operations on the Atlantic Avenue line are to be begun as soon as the frost leaves the ground. The hearing of the State Board of Railway Commissioners on the subject of the application of the railway companies will be given on January 6.

The articles of incorporation of the Adirondack and St. Lawrence Telegraph and Telephone Company have been filed in the County Clerk's Office. The company intends to construct lines through Herkimer, Hamilton, St. Lawrence and Franklin Counties. It has a capital of $75,000.

Contracts for private wires from the Produce Exchange expire March 1. These wires are leased by big operators as a rule, and the plan is not popular with some of the smaller men. Efforts are likely to be made to prevent the renewal of the contracts, so that all the brokers will be put on the same footing. The cost of a private wire to Chicago is $18,000 a year.

The Long Island City Board of Aldermen has voted a contract to the Long Island City Illuminating Company to light the pricipal streets and avenues for a term of five years at $160 per lamp per year. There are no restrictions in the contract as to the number of lamps to be erected. Mayor Gleason is the principal owner of the stock of the company, and the contract was rushed through the Board with extreme haste.

The arguments on the motion to have continued the injunction restraining the Stock Exchange from interfering with the tickers of the Gold and Stock Telegraph Co. have been heard in the Court of Common Pleas by Judge Bischoff, who has reserved his decision. G. H. G.

THE INTERNATIONAL ELECTRIC SUPPLY COMPANY.

This company has recently been organized for the purpose of extending the trade in electrical machinery and apparatus between North and South America. It will act as general agents between purchasers in South America and manufacturers in this country, facilitating the supply of electric plants for arc and incandescent lighting, transmission of power for mining and other purposes, electric traction and all smaller electrical apparatus. The scope of the company's operations will not be entirely confined to the continent to the south of us but any foreign trade in electrical supplies and machinery will be attended to. Contracts will be made for the complete equipment of central stations or isolated plants for all purposes in any part of the world. Mr. W. H. Fleming, the general manager of the International Electric Supply Company, is well qualified to direct a business of this class as he has had considerable experience in electric lighting companies in this country, and has acted as superintendent of central stations in both the East and West Indies.

PERSONAL NOTES.

Mr. Geo. B. Shaw, general manager of the National Electric Manufacturing Co., of Eau Claire, Wis., was in Chicago during the week.

Mr. C. A. Daigh, of St. Paul, was in Chicago for a short time this week.

After a tour around the world, Mr. F. J. Sawyer who formerly was in partnership with Mr. Edward Blake as New England agents of the Sprague Electric Railway and Motor Co., has identified himself with the Duval Metallic Packing Co. and has opened offices at 146 Franklin St., Boston. He will also handle the "Mass" Grease, Air and Mud Extractor.

COMMERCIAL PARAGRAPHS.

Messrs. Pinkham and Godfrey will build the switchboard for the new Bowdoin Square theatre, Boston.

The Mason Regulator Co., Boston, which publishes those invaluable little handbooks for engineers and steam users, has quite sold out the last edition and is having another edition struck off to keep up with the demand.

The Electro-Novelty Co., Knapp St., Boston, which has recently placed an unique little motor on the market for operating mechanical figures and groups, has "struck it rich" this Christmas. These electric comicalities are in all the toy stores and being rapidly bought up by and for the little folk.

The Great Western Electric Supply Co., of Chicago, report business as being brisk; their Sun arc lamps, focussing arc lamps "K K" wire, electric light fixtures and other specialties are in good demand.

On Thursday of this week the Eastern Electric Cable Co., Boston, shipped a car load of wire for use in an extensive electric mining plant in the west.

Messrs. C. A. Schieren & Co., the well known belt manufacturers, have just shipped from their Boston branch the following: Two perforated electric belts to the Edison Illuminating Co., Newport, R. I.; three do. to Fall River Electric Light Co.; one do. to the Industrial Improvement Co., Brockton, Mass.; one regular electric belt to the Brookline Gas Co., and one do. to the Waltham Gas Light Co. Two American joint link belts have also been made and shipped to Presque Isle, Me. These were all for electrical work and afford some indication of the popularity of Schieren belts.

The increasing business done by the Crocker-Wheeler Electric Motor Company, New York, has made it necessary for them to secure more room for manufacturing purposes. They have taken additional space in the buildings occupied by them at 430-432 West 14th Street, and will put in some new machinery.

The Electrical Appliance Company have made a new departure in the electrical supply business by publishing a catalogue especially devoted to toys and novelties for the holiday trade. Early in December they printed quite an elaborate little catalogue of this character which they have distributed all over the country through the medium of the young people's periodicals and which is bringing in quite a valuable trade in a small way. The Electric Appliance Company certainly deserve credit for this original idea of placing before the people in general an opportunity of securing good mechanical toys and novelties.

INCORPORATIONS.

Nebraska Power Company, Omaha, Neb.; capital stock, $25,000; to own, control, sell and lease certain inventions by one Whitcomb L. Judson; to construct street railways in towns in Nebraska and Council Bluffs, Ia., power supplied by means of said inventions and patents; promoters, J. A. Creighton, Lewis L. Reed.

Colchester Electric Light and Power Company, Colchester, Ill.; capital stock, $6,000; to furnish electricity for fuel, lighting and power; promoters, S. D. Mills, Jno. E. Hall, M. P. Agnew.

Sprague, Duncan and Hutchinson, (Limited.) (Incorporated in Florida), New York City, N. Y.; capital stock, $50,000; promotion, construction, management, purchase, sale, etc., of electrical undertakings and securities of all kinds and such other business as may be incidental thereto; promoters, Frank J. Sprague, Alfred Bishop Mason and Cary T. Hutchinson.

Fairbury Electric Light and Power Company, Fairbury, Neb.; capital stock, $30,000; contract for construction of line, of wire for transmission of electric currents for lighting and power purposes; to act as electric engineers in construction of all kinds of electrical work, etc.; promoters, H. E. Chubbucks Fred. W. Allen, Frank Dungan, Sam'l W. Schweitzs, R. B. Howell, Fairbury, Neb.

The Mexican Chemical-Electric Co., Chicago, Ill.; capital stock, $2,000,000; to manufacture and sell galvanic batteries, portable electric lamps, fans, pumps and all other things appertaining thereto, also to sell rights for any towns, cities, counties and states in the Republic of Mexico; promoters, W. S. Baker, B. H. Ottinger and J. C. Ottinger.

The Boonville Electric Light and Power Company, Boonville, Ind.; capital stock, $10,000; to manufacture electricity and electric lights and other kinds of light, and to furnish motive power for the running of other machinery and for the sale of electric and other forms and kinds of light; promoters, L. J. Miller, S. B. Hatfield, C. M. Hammond.

Green River Coal and Coke Co., Seattle, Wash.; capital stock, $1,000,000; general coal, coke, railroad, steamboat, manufacturing, mining, smelting, mercantile business; also erection and operation of gas and electric light works and water works; promoters, J. H. Bryant, Jos. E. Cox, New York, N. Y., A. S. Dunham, Wesley Wilson, John Craig, of Seattle, Wash.

ELECTRICAL PATENT RECORD.

Letters Patent Issued Dec. 22, 1891.

DYNAMOS AND MOTORS.

465,594. System of Electrical Distribution. Frederick A. La Roche, Philadelphia, Pa. Assignor to the La Roche Electric Works, and George H. Earle, Junr., same place. Filed Oct. 9, 1890.

465,808. Dynamo Electric Machine. Réné Thury, Geneva, Switzerland. Filed Aug. 4, 1891.

LAMPS AND ACCESSORIES.

465,444. Electric Switch. Henry Barton, London, England. Assignor to John Abbott Iliffe, same place. Filed Dec. 13, 1890.

465,470. Globe Holder for Electric Arc Lamps. Horatio A. Foster, New York, N. Y. Assignor to the Thomson-Houston Electric Company of Connecticut. Filed Nov. 3, 1890.

465,508. Cut-out for Incandescent Lamps. Herbert C. Wirt, Boston, Mass. Filed March 28, 1890.

465,511. Electric Snap Switch. William S. Andrews, New York. Assignor to the Edison General Electric Company, same place. Filed May 7, 1891.

465,512. Rheostat. William S. Andrews, and Alfred K. Warren, New York, N. Y. Assignor to the Edison General Electric Company, same place. Filed August 25, 1891.

465,514. Electric Arc Lamp. Henry P. Ball, Brooklyn. Assignor to the Edison General Electric Company, New York, N. Y. Filed June 13, 1891.

465,618. Electric Switch. Gwynne E. Painter, Baltimore, Md. Assignor of one-half to James F. Morrison, same place. Filed April 16, 1891.

465,684. Incandescent Electric Lamp Fixture. Gustav E. Villaret, and Victor E. Rondel, Philadelphia, Pa. Filed May 23, 1891.

465,685. Electric Arc Lamp. Henry C. Waldecker, Austin, Minn. Assignor to Winfield S. Pierce, same place, Samuel H. Pierce, Hudson, Wis., and Harry F. Batchelor, Miles City, Mont. Filed April 8, 1891.

ELECTRIC RAILWAYS.

465,447. Guard for Trolley Wire Insulators. Francis O. Blackwell, Lynn, Mass. Filed May 29, 1891.

465,469. Electric Railway Trolley. Charles S. Foster, Whitesborough, New York. Filed May 31, 1890.

465,592. Gearing for Electric Motor Cars. Owen F. Evans, Columbus, Ohio. Assignor of one-fourth to William H. Slade, same place. Filed Jan. 24, 1891.

465,613. Electric Railway. William H. Applegate, Atlantic, Iowa. Assignor to the International Railway Company, Chicago, Ill. Filed Nov. 10, 1890.

465,806. Electric Railway Trolley. Frank J. Sprague, and Patrick F. O'Shaughnessy, New York, N. Y. Assignor to the Sprague Electric Motor Co., same place. Filed Jan. 22, 1889.

TELEGRAPH, TELEPHONE AND SIGNALLING DEVICES.

465,501. Train Signaling Apparatus. Paul Synnestvedt, Chicago, Ill. Filed Oct. 13, 1890.

465,648. Combined Signal and Telephone System. Thomas W. O'Brien, Wilkesbarre, Pa. Filed July 20, 1891.

465,778. Adjustable Support for Telephones. Charles H. Gatchell, Fredericton, Can. Assignor of one-half to Albert James Gregory, same place. Filed Aug. 26, 1891.

CONDUITS, CONDUCTORS AND INSULATORS.

465,564. Conduit for Electric Wires. Henry W. Johns, New York, N. Y. Filed April 1, 1891.

MISCELLANEOUS.

465,525. Electrolytic Apparatus for Treating Metals. Edward S. Hayden, Waterbury, Conn. Filed Nov. 5, 1887.

465,548. Annunciator for the Supposed Dead. William H. White, Topeka, Kansas, Filed Nov. 24, 1890.

465,602. Electric Circuit Closer for Burglar Alarms. William Thompson, Minneapolis, Minn. Assignor to the Western Electric Company, Chicago, Ill., Filed Oct. 19, 1889.

465,655. Independent Electric Clock. Walter J. Dudley, Somerville, Mass. Filed July 11, 1891.

465,805. Means for turning on and off Electric Currents. Thomas C. Smith, and Benjamin D. Acker, Philadelphia, Pa. Assignors to Isaac C. Walker, and Henry G. Kepler, same place. Filed Oct. 1, 1890.

465,809. Electrical Testing Instrument. Richard Varley, Jr., Englewood, N. J. Filed Jan. 15, 1891.

ELECTRICITY.

VOL. I. NEW YORK. JANUARY 6, 1892. CHICAGO. No. 25.

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ELECTRICITY.

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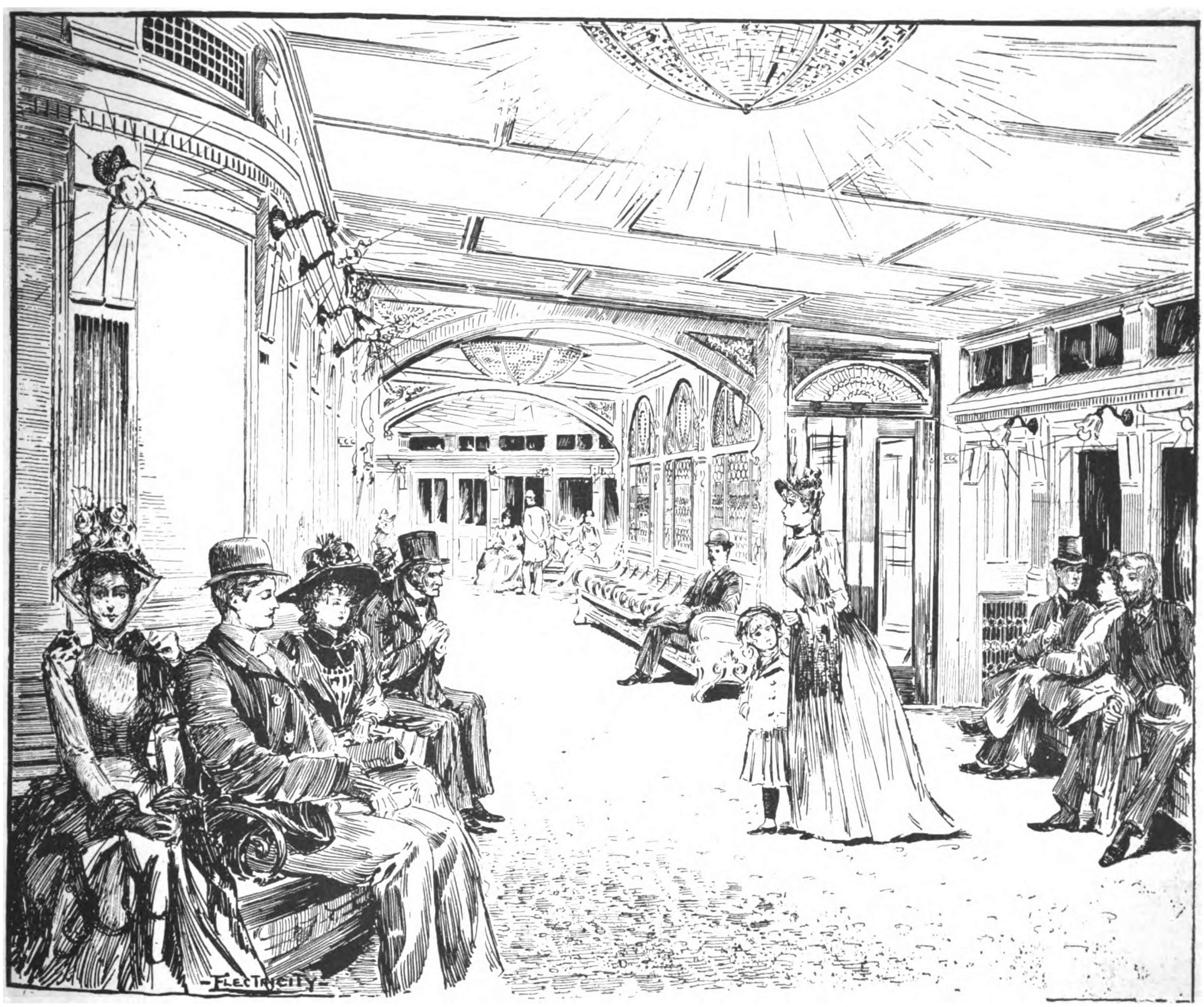


ELECTRIC LIGHTING ON THE FERRY BOAT "CINCINNATI."

(*See page* 312.)

ELECTRICITY.

VOL. I. NEW YORK. JANUARY 6, 1892. CHICAGO. NO. 25

ELECTRIC LIGHTING ON THE FERRY BOAT "CINCINNATI."

(*See page* 312.)

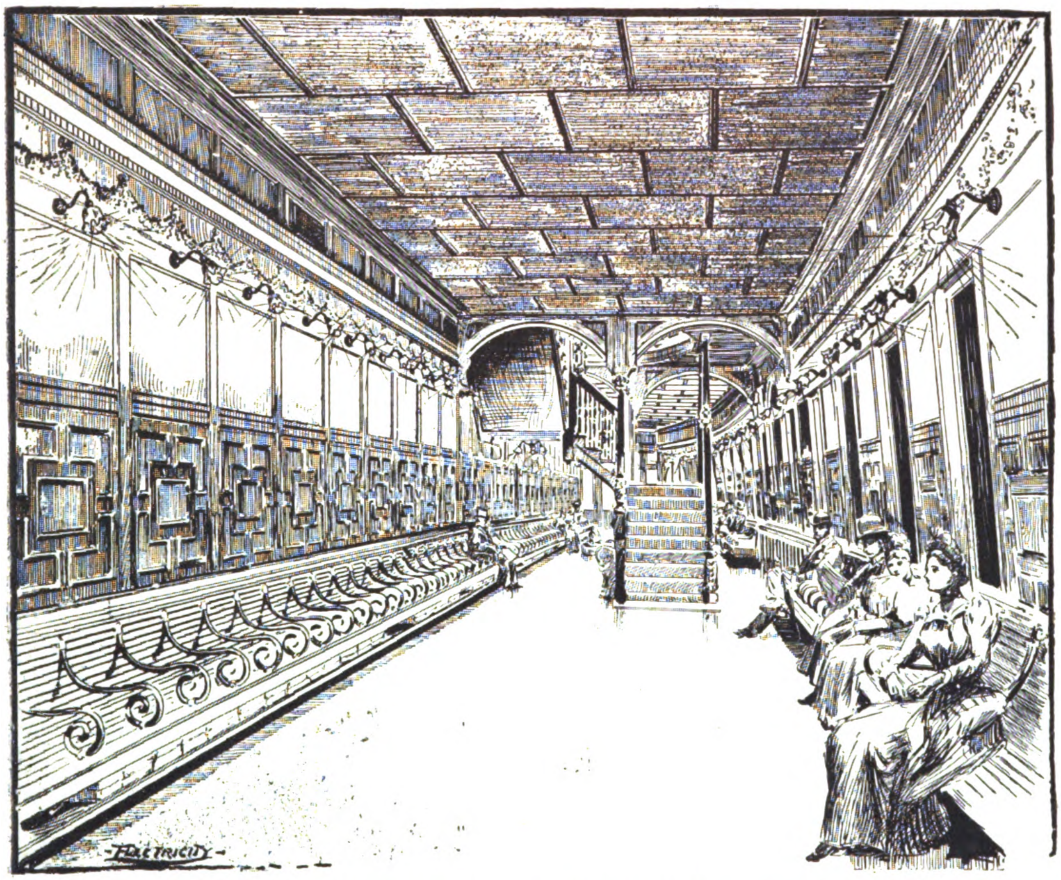
ELECTRIC LIGHTING ON BOARD THE PENNSYLVANIA RAILROAD CO'S SCREW FERRY BOAT "CINCINNATI."

The latest improvements in the construction of ferry boats have been utilized in the new ferry boat of the Pennsylvania Railroad Co., the *Cincinnati*. This boat was designed for service between New York City and the Jersey City station of the Pennsylvania railroad. An important modification in this typical modern ferry boat is the use of screws instead of paddle wheels for propulsion, and the many advantages thus rendered possible are clearly apparent in the new boat. About two years ago the feasibility of adopting screws for ferry boats was first established, and since then the building and placing in service of the *Bergen* has dispelled all doubts as to the practicability of applying screw propulsion to this class of river craft. The further success of the *John G. McCullough*, built for service on the New York, Lake Erie & Western R. R. ferries, in the matter of ease of handling, surplus of power and high speed, influenced the decision of the Pennsylvania Railroad Co. to construct two boats of the same type.

The first of these, the *Cincinnati*, has been plying with most satisfactory results for the past two months. The design of the earlier boats has in some measure been departed from, especially in the case of the engines, which, instead of being triple-expansion, as those of the *Bergen* are, are of the steeple-compound type, the low pressure cylinder being mounted on top of the high pressure cylinder, and having a common piston rod. The principal dimensions of the boat are: length over all, 206 ft.; length of hull, 200 ft.; beam over guards, 65 ft.; beam of hull, 46 ft.; depth of hull, 17 ft.; draft, 10 ft. 10 ins.; displacement, 890 tons.

Anyone who wishes to realize the immense superiority of the new style of ferry boat cannot do so more satisfactorily than by taking a trip across the river on a rainy day by the *Cincinnati* and returning on one of the older boats. The latter have all the stuffy, clammy atmosphere which has come to be regarded as inseparable from the ferry boat under such conditions, while the new boat is light, roomy, and well ventilated. On a trip by night the real luxury of the screw ferry boat is even more markedly apparent. Rows of incandescent lamps on silver brackets, and with opalescent shades, run from one end to the other of the lower saloons, and of the saloon on the upper deck, and fill the boat with cheerful light. The lower saloons, which are tastefully paneled, are painted in metal gray, and the dentils and mouldings in the panels are covered with aluminum leaf. The windows are of heavy plate glass; those at either end and in the centre are handsomely ornamented with designs in leaded glass.

One of the most striking features is the absence of the usual paddle wheel house. In its stead is a handsomely carved stairway of mahogany, which leads to the upper deck. At the top of this staircase is an oval-shaped dome, adjacent to which is a large sunlight set in the roof of the saloon. This is thickly studded with beaded glass, through which, intensified by reflection, the light of a cluster of incandescent lamps gives a more brilliant effect. The upper saloon is painted in salmon color, and the floor is richly carpeted. To ensure a soft and uniform light nothing but electric lamps are used throughout the boat.



ELECTRIC LIGHTING ON THE FERRY BOAT "CINCINNATI."

The lighting plant consists of two dynamos, one a United States 200-light, and the other an Edison 35-light machine; each machine is run by separate "Ideal" horizontal engines. Of the total number of 200 lamps with which the boat is fitted, the large dynamo feeds such as are used at night for the illumination of the saloons. The smaller dynamo supplies the signal lamps and the cabins and such lamps as are in use in the hold, engine rooms, and elsewhere during the day. An additional advantage of the smaller dynamo is that it is held in reserve for use in case the necessity arises of stopping the large machine. Every known precaution has been taken in the wiring of the boat to avoid risk of fire, and the wires may be regarded as absolutely safe. Another point of excellence is the special arrangements for heating and ventilating. The ordinary method of heating ferry boats by steam pipes placed under the seats, and ventilating by means of holes in the ceiling, answers fairly well on short-trip ferries, where the frequent opening and shutting of the doors at the end of the cabins gives a certain supplementary ventilation, but there are times, as every passenger knows, when the heaviness and foulness of the air become almost insupportable. In the *Cincinnati* the fresh air is taken from a point above the upper deck, through a vertical pipe, and passed to a Sturtevant blower near the engine room. The air is then forced along the steam pipes. It can be brought to any required temperature, according to the speed of the blower and the pressure of the steam in the pipes. From these heating coils the air passes by pipes to the different cabins, the largest pipe supplying the men's cabin where the air is sure to be vitiated with tobacco smoke. The women's cabin and the cabin on the upper deck are supplied by separate pipes. In order to avoid drafts, the warm, fresh air is delivered through openings in the inner wall of the cabins near the ceiling. The foul air exits are placed under the seats, and conduct the air to the vehicle gangway. The temperature of all the apartments is governed by electric thermostats which control valves for the proper regulation of the hot and cold air supply at the heater.

Effective signalling arrangements are established between the engine room and the pilot house, which show the engineer the direction in which the boat is going, and the pilot the speed and direction of the revolution of the shaft. An additional safeguard against fire is provided by the absence of wood in the construction of the boat below the main deck. The efficiency and appearance of the *Cincinnati* reflect great credit on Mr. H. S. Hayward, superintendent of the Motive Power Department of the United Railroads of the New Jersey division of the Pennsylvania Railroad, who supervised the designing and construction of the boat. The sister boat to the *Cincinnati*, the *Washington*, which is to resemble her in every detail, is to be ready for service in three or four months.

BROOKLYN AND THE TROLLEY.

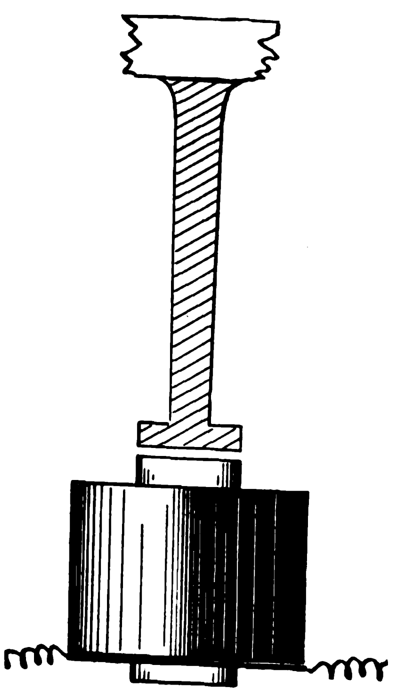
The old adage of "What is one man's meat is another man's poison" can be fitly applied to the question which is now exercising the people of Brooklyn, as to what system of traction they can most advantageously adopt for the purpose of carrying them along the streets of their rapidly growing city. The more intelligent of the citizens believe that the city will be all the better for the proposed trolley system, and recognize that the ridiculous stories that the enemies of the system propagate as to its danger to human life find their origin more in interested motives than in truth. Another section of the community object to the trolley because they really believe all the talk about the "deadly trolley," which, in spite of its "deadliness," has never failed to bring increased prosperity to the cities in which it has been legitimately introduced. That there are other reasons why some of the citizens of the City of Churches do not want the system is proved by the philosophical strictures of the driver of an Atlantic Avenue car who opened his heart to a reporter who was on the front platform of the car the other night. His opinion was that "the new fangled system was an idea of 'Deacon' Richardson's, and the only reason the Deacon had for it was to make more money. Now," he continued, "that's a mistake, and the Deacon is old enough to know better. He can't live very much longer, and he can't take his money into another world with him. This world is all vanity and is soon over. If man was only content he would be happy. Now, look at me. I stand here ten hours every day and get just enough to keep body and soul together, but I'll bet you a hat I am happier than the Deacon. Why, he don't know what happiness is alongside of me; don't know the meaning of the word, and it's all because he's trying to make money, nothing but money. It's all a vanity of the flesh, I tell you, all a vanity of the flesh. The horses are good enough for me."

FRAUDS IN THE ELECTRICAL BUSINESS.*

BY A. A. KNUDSON.

This subject, unfortunately, is one of such wide scope that to cover it fully would mean the publication of a good sized volume. For a paper of ordinary length, therefore, I shall only touch upon the various branches of electricity in which impostors have left their tracks, and relate a few instances as they have come under my notice during the past few years, which will show some of their methods. I wish it understood that in speaking of impostors or fakirs in this paper I mean only those who, knowing an invention to be worthless, or of but little value, attempt by false statements to induce people to put money into them. Of course I do not wish to include under this head those inventors who, honestly believing they have discovered something new and original, seek to interest capital, although their scheme may finally prove impracticable or to have been previously patented.

We will now consider one or two fakir methods in the galvanic battery line, which, as we all know, has proved in the past an inviting field for

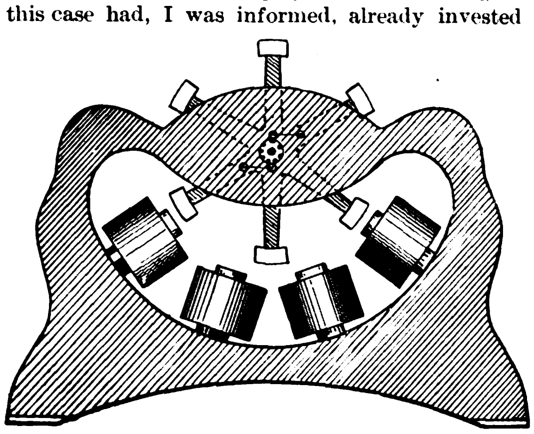


THE ELECTRIC MOTOR—SIDE VIEW.

that class of men. The first is the primary battery with the electric motor. Some years ago before the advent of the dynamo, when electric motors had to depend upon the primary battery for current, a French gentleman appeared in New York with alleged new and useful improvements in both battery and motor. He had induced a relative of mine (since deceased), who was an officer in a savings bank, to invest in his scheme, and had been given the use of an unoccupied room above the bank for the purpose of exhibiting the apparatus. I was asked to call and examine this "wonderful invention," for according to the inventor, it was one of the greatest scientific productions of the day. The motor did not differ in principle from those already invented and described in print, such as that of M. Froment, or of Davenport on this side of the water. In fact it was not only the same in principle as that of Froment's, but nearly the same in construction. The battery, the inventor said, was a secret, and he would not explain it. The method of demonstrating the efficiency of both motor and battery was by lifting a weight of a few pounds to the ceiling by means of a pulley and rope, the rope being wound around a drum secured to the shaft of the motor. The battery, although a secret, disclosed itself soon after the motor was started, by the strong nitric acid fumes it gave out and by the active manner in which it boiled. When spoken to about the strong odor from the battery, which was enough to choke one, the explanation would generally be (with an attempt to smell) "You smell anything?" My report, as you will surmise, was not favorable, and I strongly warned the banker to go no further, but he had actually become so wedded to the scheme that he would believe nothing against it, and all I got for my pains was a self-satisfied smile and the remark, "Well, I can believe my own eyes when I see that weight going up to the ceiling."

You will anticipate the outcome; I left them to themselves and to their own eyes; and after several thousand dollars had been sunk in the attempt to make the scheme practical, it was finally abandoned. The banker frankly acknowledged afterwards that he believed the whole thing was gotten up with the deliberate intention to deceive. So much for that wonderful motor and the battery that was a secret.

Another case—and this will illustrate how people will sometimes put their money into a scheme and afterward seek advice in regard to it—was one which came under my notice a few years ago, where the primary battery played a conspicuous part (although concealed in the cellar) and was, like the one in the previous case, a secret. It had for its object the production of an electric light. The gentleman who employed me to investigate this case had, I was informed, already invested



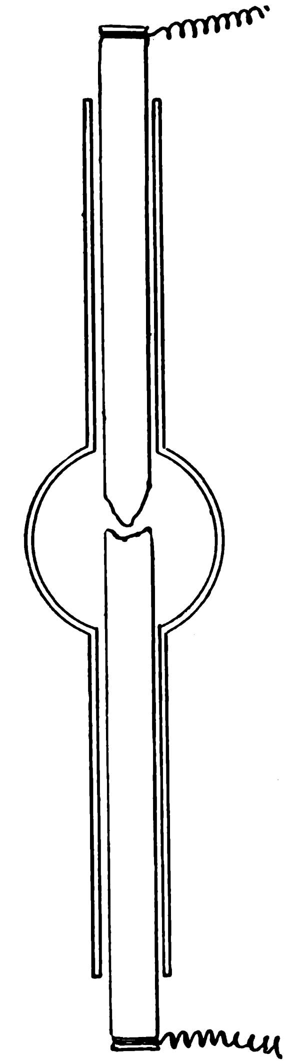
THE PATENT ELECTRIC MOTOR.

something like $20,000 in the scheme. Knowing this, I certainly expected to find something at least worthy of an invention. It is a singular fact, however, and one that I have often come across, that instead of getting full and trustworthy advice before embarking in a venture, people will often invest their money, and then afterwards, when a sense of doubt and insecurity dawns upon them, will fly to an expert.

The object of this invention, as already stated, was the production of electric light. It was exhibited in a room ordinarily used as a dining-room in a private house. There were three or four lights placed on the chandelier, and when the current was turned on they did make a brilliant and steady light while it was being shown. It consisted of two small carbon rods placed inside a glass tube, the point of contact between the carbons being about mid-way between the ends of the tube, which was about six inches long, with a bulb at the centre. The wire from the battery connected with the carbons, and that was practically all there was to the invention. The inventor succeeded, even before any patents were obtained, by reason of his exceeding plausibility (he was a remarkably good talker), in inducing these gentlemen to put in this large sum of money. Why, to hear this man talk was enough to deceive the very elect if they were not posted, and to show how easily some men are induced to invest in worthless enterprises of an electrical nature when in the hands of a good talker.

I will give an example of the way he talked—Edison was nowhere. For years Edison had been trying to accomplish what he had already just perfected. In Edison's system enormous capital was required in the construction of central stations, besides the cost of running expenses for fuel, labor, etc., but in his system all of this was done away with, and for a few cents per night a whole house or store could be illuminated, and the battery would run indefinitely; and so on, ad infinitum.

All this time he was careful to conceal the fact that he was using in the battery in the cellar electropoion fluid by the barrel and sheet zinc by the square yard in order to run the three or four lights for comparatively short intervals of time. He told the gentlemen present and myself that there were but four cells of battery in circuit. This to me was surprising for the amount of illumination given. By a series of cross questions we finally found out just what he had. The four cells of battery consisted of four enormous earthenware crocks, holding about twenty-five gallons each. Across the top of each jar or crock was placed a bar of wood



THE ELECTRIC LIGHT.

to which were secured various plates of carbon and zinc running down the bottom of the jar, so that instead of four cells or galvanic pairs in circuit, there were actually nearer forty, of very large size, and the beautiful and brilliant electric light on the chandelier was duly accounted for. I do not suppose that the gentlemen who had invested their money in this scheme thought it worth while to even inquire about the battery. They saw the light, and, like the banker in the former case who saw the weight and heard the inventor talk, they thought they could believe their own eyes. After the exposure was made, there was no more money invested in that scheme. I could give many other instances where the impostor had manipulated the galvanic battery to his own profit; but as they would be almost repetitions of those just stated, we will pass on and look into some of the fakir's work in the electric and acoustic telephone business.

I presume there is no electrical business of late years which has been so thoroughly worked by unprincipled men as the telephone business, and in

*A paper read before the New York Electrical Society, December 30th, 1891.

order to have a better understanding of the methods of telephone sharpers, I will give a short resumé of the telephone situation, as we understood it a few years ago. Where important law suits have been going on, the amount of fraud occasionally practiced in the attempt of one company to secure an advantage over another, would, if made known, be surprising. Bribery and false swearing has often been resorted to in some of the telephone patent suits in past years. Witnesses, experts, lawyers, and even the Judge on the bench, have not been entirely free from the baneful influence. I will give an instance: You may have heard of the man who was an examiner in the electrical department of the Patent Office at the time the Bell patent was issued, and who in later years, for a certain sum of money, made an affidavit in favor of the Bell Company, setting forth certain alleged facts which occurred at that time, and who not long afterward accepted a fee from another company and made another affidavit setting forth alleged facts entirely contrary to the first sworn to. It often happens in patent suits where large amounts of money are involved that the temptation is strong to mislead and deceive, wherever such deception will be of advantage.

Especially was this the case in the legal telephone fight, during the attempt made to overthrow the Bell patent by attempting to show that the Reis telephene would articulate. It was well known that if the telephone invented by Reis in Germany (which ante-dated the Bell by several years), could be proved to have talked, and to have actually produced articulate as well as musical sounds, it would mean death to the Bell patent. Or if a telephone made exactly on the principle of the Reis could be shown to articulate in court, if only for five minutes, it would in all probability upset the Bell patent, the advantages of which would thus revert to public use. Hence, there was abundant reason for the opponents of the Bell Company to prove if possible one thing or the other, and the utmost exertions were put forth. Germany was ransacked for relatives and for those who had been acquainted with Reis during his life-time, and affidavits and witnesses were obtained by the score, attempting to prove when, where, and how the Reis telephone talked; without doubt, many of these affidavits were drawn from distended imaginations, while others were but partially true.

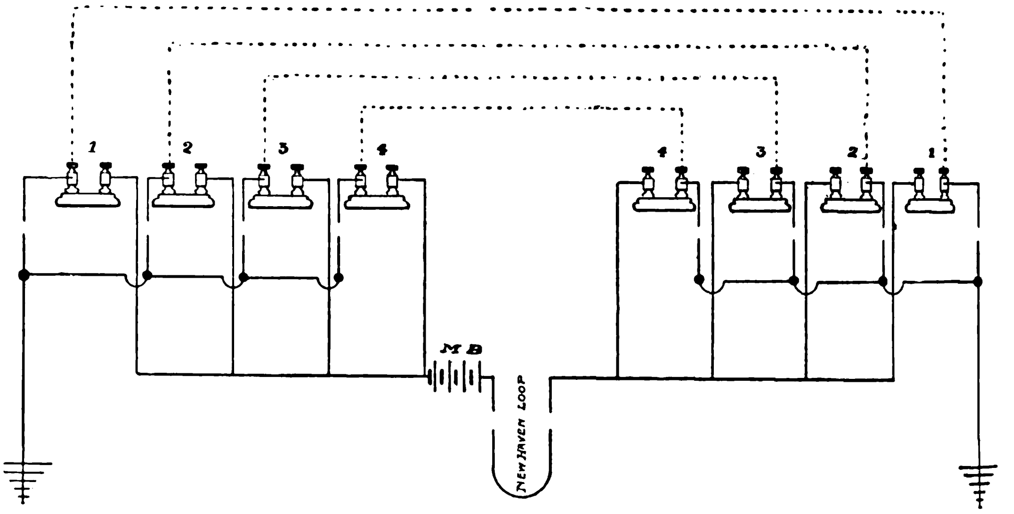
On this side of the water numbers of inventors were at work struggling for the prize in their efforts to make the thing articulate. I well remember the experience Mr. Mailloux and myself had in that direction. Night after night we worked at our homes in Brooklyn with varying success. Sometimes we would succeed in making it articulate, but our experience was that it was impossible to make it stay in that condition. We finally came to the conclusion that it was possible to make a Reis telephone talk, but that it could not be depended upon to stay in a talking condition from one minute to another, and so far as my knowledge of this subject extends, no telephone made exactly after a Reis pattern has ever been able to articulate for any length of time. When they did articulate it was probably on account of either an extremely delicate adjustment, which was only temporary, or the oxidation of the contact points, which for a time created the variable resistance that is the life of articulation. But we could not trust it to remain in that condition over night. Often did we lay it carefully on one side after working for hours at night, feeling that at last we had it, to find it in the morning as dumb as an oyster, and finally we abandoned the attempt entirely.

There was one man, however, (and this is more in line with my subject in speaking of frauds), who claimed to have produced a constant talking Reis telephone, and to the consternation of the Bell Company he actually showed it in a good talking condition. There could be no fault found with the articulation; it did talk and talk well, and things for a time looked blue on the Bell side of the house, until one of their experts more observant than others discovered a carbon button concealed in a box and connected in the circuit; so that it was not a genuine Reis telephone that produced the articulation, but one with the necessary modern improvement.

I once had a telephone case to investigate which will show to what extent a fake scheme will sometimes go before it finally reaches its end. There were but two papers furnished me to examine, one a copy of the patent, (there was but one patent), and the other a copy of the prospectus The claims of the patent were exceedingly limited, but the prospectus was broad enough to make up for any deficiency in that respect. One clause in the patent set forth that this invention was based on the undulatory current principle, while a clause in the prospectus stated that the invention was not based upon the undulatory current theory but upon the make and break principle, a square contradiction, on its face. In point of fact it did not differ, except in construction, from the Bell telephone. The parties to whom I reported did not invest in the scheme, but other parties did, and a company was started. Their method of doing business was to manufacture the telephones here in New York, sell State rights on the patent, and establish local companies in cities and towns wherever they could, and supply them with telephones. In this way they earned in course of time sufficient money to pay a dividend on the stock and the stock advanced (a good deal of it being sold),and everything went on swimmingly. About this time I was asked by the party for whom I reported if I had not made a mistake, and they pointed to the fact that a dividend had been paid by the company. I said I thought not and advised them to wait a little longer. The Bell Company, through the slow process of the courts, finally reached them, and they were blotted out of existence. A similar experience, as we all know, happened to a large number of other companies who attempted to compete with the Bell Company.

In the acoustic telephone business it seemed at one time as though it was infested with fakirs. There seemed to be just as strong inducements in the acoustic field for this class of people as in the electric, especially after the Bell patents had been sustained by the Courts. I presume one reason was that there was no difficulty in convincing people that there was no infringement on the Bell patent, as it was easy to show no electricity was used to carry the voice, and another reason was that an acoustic telephone when first put up for exhibition purposes generally worked surprisingly well. The voice could usually be heard from ten to twenty feet away from the instrument, and the promoter would not be slow to exaggerate these advantages and to characterize them as fully as important and valuable as the Bell telephone. Nothing would be said about the difficulty of constructing the wire and of keeping it in repair, and in most cases those investing would hardly inquire if there were any wire at all, when in point of fact, the wire is the most important part of the whole business of an acoustic telephone line. The difficulty of maintaining it is well known. In this respect this case would be similar to those above mentioned where people saw a weight go up, and saw a beautiful electric light. They thought they could believe their own eyes, and when some people listened to the remarkable performance of the acoustic telephone they thought they could believe their own ears. The acoustic telephone has its place in the commercial world, and in its place is most useful and convenient; but in the past it has been badly misrepresented by being exaggerated by men whose only ambition was to sell stock in fake companies.

We will now leave the telephone business and pass on to the consideration of telegraph frauds. Some years ago a French Canadian appeared in Hartford, Conn., making a great stir about a new multiple telegraph system, which he claimed to have invented. According to his story, he could send and receive upwards of forty messages over one wire. The duplex and quadruplex were but child's play in comparison, and so plausible were his other assertions concerning it, that he succeeded in interesting some parties and finally obtained from them a considerable sum of money for an interest in the scheme. For a complete fraud in every detail, this beat all I have ever heard of in the electrical business. It was an ingenious swindle, and in order to describe it more fully I have prepared a diagram of the connections. A few instruments only are shown, but they will be sufficient to illustrate the scheme. Several sets of Morse instruments were placed at each end of a room and a wire loop was run to New Haven, in which wire the main battery was placed, as shown at MB. From the ends of this loop, AA, wires were branched to one of the two binding posts of each instrument; from the other binding post ran a wire, to all appearances, to the ground, but it did not go there at all, for it was purposely broken inside of the insulating covering, and the ends pulled apart. Another very fine wire was connected to the bottom of this same binding post at each instrument, carefully concealed, and led to the side of the room, where it was hidden entirely from view behind the paper on the wall. These fine wires were all connected with the opposite instruments in their respective pair at the other end of the room. The wire in the long loop to New Haven, as you will observe, simply acted as a return ground, or one side of a metallic circuit. Under such conditions the multiple scheme, as you would expect, worked perfectly, and with any number of



THE FRAUDULENT MULTIPLEX—DOTTED LINES SHOW WIRES BEHIND THE WALL-PAPER.

instruments. After the inventor had absconded with his money, which he did shortly after he got it, the instruments were removed from the room, and then the fraud was discovered, for there were the wires all carefully concealed behind the wall paper.

Electrical frauds have visited the U. S. and plied their vocation in almost every country on the face of the earth, but this man was from Canada, a country one would hardly expect to produce such a clever electrical swindler, and he showed a surprising nerve by going right into the heart of Yankeedom, the State of Connecticut, where the people's reputation for shrewdness is so well known that it has been said that in order to dispose of some of their products, such as wooden nutmegs, etc., they are compelled to go outside of the State to do it. During my sojourn in Canada for the past four years, I have met but one or two who could be termed electrical fakirs and they came from the States.

Another phase of electrical frauds may be illustrated in a recent exhibition of a scheme in Boston. The inventor showed a battery of peculiar construction, to the zinc pole of which was attached a wire leading out of doors to a lightning rod a short distance away. The wire from the other pole of the battery went somewhere, but was supposed to go to the ground. The object of the scheme, according to the inventor, was to produce a constant and unlimited supply of electricity from the air. To show the practicability of the scheme a motor was placed in circuit and it ran as though it would burst. An ordinary Morse sounder was tried, and that worked as though it would be torn to pieces. Mr. Frank Pope examined the scheme but was not allowed to go into it thoroughly, and he said he couldn't tell just where the fake was, but it was there somewhere, and he advised the capitalist who was with him, and who was in the electrical business, to get some of his electricians to try and duplicate it if they could. I am sorry this scheme was not unearthed, for I believe it would prove an important addition to this paper.

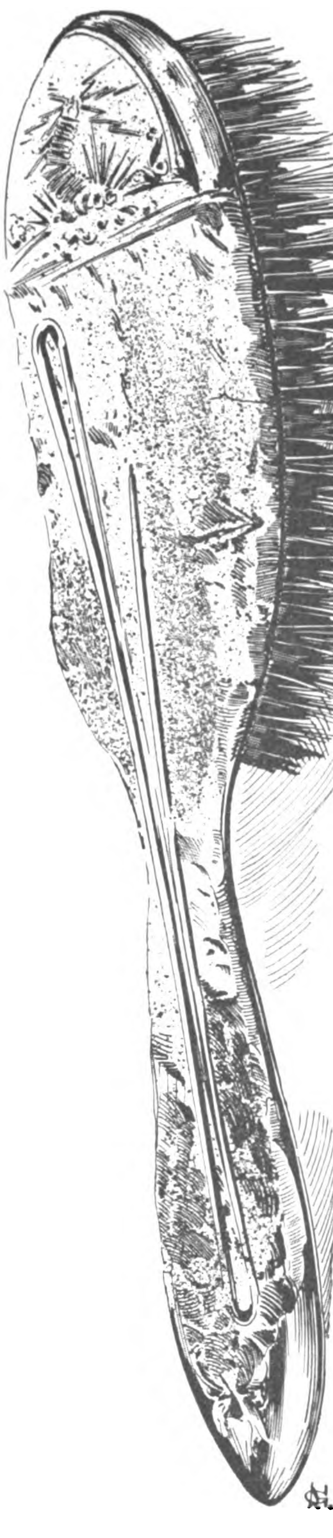
As a conclusion to this list of electrical fakes we will now consider the medical part of the business. Here we find among the so-called electrical appliances, such as belts, hair brushes, corsets, etc., that gross imposition is practised under the name of electricity upon the public, and has been for years. There is hardly a complaint in the calendar of human diseases that these things, according to the flaring advertisements and circulars issued by their energetic promoters, will not cure. To show to what extent this imposition is practised at the present day, I will read an extract or two from a full page advertisement taken from one of the most highly respectable magazines in this country.

"Disease is the result largely of depleted nerve force and demagnetized blood. These Electro-Magnetic Corsets (the makers name is here mentioned) Belts, Insoles and appliances have been demonstrated to be the best agency yet discovered for preventing this depletion and demagnetization as well as restoring such forces when lost. These garments are unlike any other device for electrifying the system or charging it with magnetism. As a force it is self-supplying, retaining its virtue for years and invariably benefits. These appliances so electrified can always be relied upon.

"These appliances promptly annihilate those weak and languid feelings, exterminate rheumatism from the system and promptly cure the above named disorders. They are light and comfortable to wear and are guaranteed to imperceptibly generate a mild continuous current of electro-magnetism, all-healing in its effect. They differ from the so-called electric and galvanic belts, which are usually worthless and which create sores on the body, leading to blood-poisoning. Beware of them and see that you get this one (our special make) with silver compass free. Ours are truly Electro-Magnetic, as any tyro in electric therapeutics will inform you, and are absolutely reliable."

You will note the attempt is made here to work in magnetism as a curative property. Except where steel magnets are concealed (of which I shall speak later), there is not one particle of magnetism produced by the action of a so-called electrical appliance of this class.

There is a point to which I wish to call special attention. Electricity, properly controlled and applied, is capable of wonderful effects in the relief and cure of a large number of diseases, and its legitimate use is increasing daily in the practice of the most enlightened and scientific medical practitioners of the age. In fact hardly a practising physician of any repute can be found who has not



THE "ELECTRIC BRUSH."

his medical batteries, some of them costing hundreds of dollars, with all kinds of electrodes, some of which are as ingenious in construction as they are humane in purpose.

It is just this point that the swindlers of to-day lay hold of and turn to their own purposes. They designedly confound electricity with magnetism, and by a skillful interchange of terms they encourage in the public mind the same confusion. In many cases where they claim that magnetism is generated by their appliances there is no magnetism at all; and in others where they claim that there is electricity there is magnetism. But this magnetism is not the result of any inherent virtue it is the result of a smart piece of chicanery, in which the concealed magnet and the compass needle play the principal part. I claim therefore, that in any event it is wrong and misleading to attempt to confound magnetism with the curative properties of electricity. I have yet to learn of a case where magnetism, either strong or weak, has ever produced any effect, either beneficial or detrimental, upon the human system. Night after night for months I have been in the presence of the most powerful dynamos (as have thousands of men in the many electric light stations all over the world) where magnetism of the strongest kind permeates every bone and fibre and tissue of the body, and yet so far as any effect on the system goes, one would never know that he had been in the magnetic field, and he would not notice it unless he found his watch stopped. To the best of my knowledge and belief there is absolutely nothing in the human anatomy that can be acted upon by a magnet. Of course, if a child swallows a mouthful of tacks or a paper of needles, there is then something inside of the child upon which magnetism will act, but not otherwise.

What physician of any reputation has ever been known to attempt to apply magnetism, or to recommend the use of electric belts and the like? On the contrary, every reputable physician with whom I have talked on the subject has denounced them as worthless. Let us go a little further into this subject and see how some of these things bear the light of an investigation. We will first consider the so-called electric hair brush. I have thought best to purchase one of these brushes so that we can see just how they are made, and to prove the assertion that so far as any curative property is concerned they are no better than any ordinary hair brush. I will first read an extract or two from the directions pasted in the box in which it came:

"Cures headache in five minutes; cures neuralgia in five minutes; restores the hair, prevents baldness. The 'Odic force' can always be tested by moving the brush near a compass. This power is so strong that if the compass is placed upon a thick book or table and the brush is moved in a circle beneath the same the power will pass through the intervening table or book and cause the needle of the compass to rotate rapidly. A silver compass of considerable value accompanies each brush."

Now, this brush I have does deflect the compass needle just as stated, but the real cause is very different from the ostensible one, and as to any Odic force (whatever that may be) or any electricity having anything to do with its deflection, the statement is false, as I shall prove. I have taken pains to disect the back of this brush and we find just what we expected to find. Embedded in the material of which it is composed is a steel magnet. That, and that alone, is the cause of the compass needle moving towards the brush when brought near it. When I purchased this brush I was told that the movement of the needle proved that the brush was charged with electricity, and I have no doubt everybody else that buys one is told the same thing. You will notice this magnet is made of a piece of steel wire in the form of a double loop and extends nearly to the end of the handle. The only electrical effect that can possibly be produced by the use of this brush is static, and even under favorable conditions of the atmosphere, the greater part of such very small amount of static electricity as might be generated while the brush was being used would imperceptibly pass off to the earth through the hand and arm and body of the user, leaving him no more benefitted by its use than if he had used an ordinary hair brush.

Electric corsets are another deception. How is it possible, I ask you, for such a thing to be of the slightest use electrically to the wearer when they are not even worn next the skin? The magnetizing of the steel ribs which is often done, can have no beneficial effect whatever upon the wearer.

(*Continued on page* 317.)

ELECTRICITY

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Electricity at the World's Fair. We print this week a paper read by Prof. Barrett, chief of the Department of Electricity of the Columbian Exposition, in which he gives some suggestions as to the work of preparing for a grand electrical exhibit at Chicago in 1893. The opinion has already been freely expressed that the electrical exhibits will so far excel, both in magnitude and completeness, any previous display of the kind, that the electrical section will be the grand central attraction of the exhibition. It was felt from the very beginning that the space accorded to the Electricity Building was wholly inadequate to allow of a really representative exhibit of industrial electrical appliances on the scale that America's position in the development of electricity demands. How far short the Electricity Building will fall in meeting the requirements of exhibitors who ought to be accommodated in it is pointed out by Prof. Barrett when he says that at this time—sixteen months before the opening of the exhibition—the space applied for exceeds the total capacity of the building, while he estimates that not one-half of the total number of intending exhibitors have yet been heard from. It would seem from this that the sagacity of the promoters of the exhibition has been poorly exercised. The world looks to America for practical developments in the applications of electricity and the important part that electricity will play in such an immense exhibition should have been recognized far more liberally than it has been The great electrical manufacturers of Europe are ready to come out in force to meet American electricians on their own ground, yet the first demand made for space from this quarter had to be inadequately met. It is becoming abundantly evident that in the allotment of space among the different industries electricity has been treated with an altogether too sparing hand. Presumably it is too late now to remedy the mistake, but we have no doubt that the Department of Electricity could easily fill up a second building as large as that now under construction.

* * *

Electrical Frauds. The paper on "Frauds in the Electrical Business," read by Mr. A. A. Knudson at the last meeting of the New York Electrical Society, which we publish in full in this issue, appeals to the interest of those actually engaged in the electrical business, and even more so to those whose connection with things electrical is more remote. It is clearly shown in the paper referred to that electrical swindles belong to two classes; first, those in which electricity is really brought into play in some more or less ingenious manner to produce seemingly wonderful results intended to bait a trap for the unwary investor; and second, those in which the name only of electricity (or magnetism) is attached to articles worthless in themselves, but which are described as having wonderful curative properties that endear them to the heart of a public which loves to be humbugged. Of the first class Mr. Knudson gives several amusing instances, all of them electrical swindles of the first water. It is easy to understand that the promoters of these little schemes may have been successful in fleecing the too enthusiastic believer in the future of electricity during the days when the industrial applications of the science had scarcely begun, but the time for such frauds as these has almost, if not quite, passed away. The only electrical swindle that still remains with us is the primary battery, and that, with the wonderful secret depolarising fluid, is likely to crop up periodically to the end of time; indeed, it made its appearance in the New York newspapers only a few months ago. Wonderful motors and systems of lighting and similar marvels, operated from a source of energy kept discreetly in the background, are not very marketable inventions at the present day when information on things electrical is so widely extended and expert opinion is so easily obtainable.

* * *

Electrical Fakes. The second class of electrical swindles to which Mr. Knudson draws attention really deserves more serious consideration, and would undoubtedly receive it more frequently and emphatically in the columns of the electrical press were it not for the utter impossibility of saving the public from itself. We have it on the best authority—that of the prince of humbugs himself—that the public likes to be humbugged, and it will probably always go on liking to be humbugged. The particular direction in which it seems to like being humbugged best is in the very important question of its own health, in witness of which are the numerous advertisements of patent medicines and specifics of all kinds which greet one's eye everywhere. Most of these much belauded articles are ridiculously worthless nostrums, but great fortunes have been made from their sale and the public doses itself with them to its heart's content. The quack knows that electricity has curative properties when properly applied, and he has heard somewhere that "electricity is life," so he strings a lot of little pieces of metal on a band of cotton and calls it an "electric belt"; he vulcanizes a magnetized steel wire into the handle of a common hair brush and calls it an "electric brush"; he magnetizes the steel strips of a corset and produces an "electric corset," and so on, *ad nauseam*. All these articles sell for high prices because the "electricity" they contain possesses wonderful curative properties which render them sovereign remedies for almost all the ills and diseases with which unfortunate human nature is afflicted. The quack does a flourishing business, advertises largely, pockets his barbarous profits and laughs in his sleeve at the public that loves to be humbugged. We can only suggest to the individuals who have such a blind faith in the curative powers of magnetism that they carry a small bar magnet in the innermost pocket. This might be called "the electrical life-preserver"; it would be just as efficacious as any electric brush, belt or corset ever made and would have the advantage of being far cheaper.

* * *

Communication With Mars. M. Camille Flammarion, the well-known French astronomor, contributes to the *New York Herald* a rambling article with the misleading title "How to Talk with the Folks on Mars," in which he discusses the problem of establishing communication between that planet and this one—the *ignis fatuus* of astronomers. M. Flammarion's first suggestion is the use of the photophone, but this is a bold plan dismissed in a couple of lines as not really being worthy of serious consideration. He next dwells on the scheme of making geometrical designs covering a few hundred square miles of the earth's surface, the designs to be traced out by electric lights. It would cost a few millions to make the experiment, but as M. Flammarion lightly suggests "it would be throwing some millions into the sea instead of throwing them into barracks." The French scientist has great faith in electricity and magnetism. He asks the question, "May not interastral magnetism play a part?" and then branches off from Mars to Ogden to discuss Mr. Edison's terrestrial electro-magnet which gives strange sounds in a telephone. It has long been established that there is a relation between the solar phenomena and magnetic disturbances upon the earth, and M. Flammarion thinks that Mr. Edison's gigantic earth current detector will yield important results, even if it do not teach us to talk with Mars, which, of course, it may. "We know nothing," says M. Flammarion. "of the nature of astral magnetism. By this gate, it may be, we enter upon an avenue that is immense and full of surprises." In another paragraph, with the truly delightful vagueness of prophecy that your scientist always adopts when writing for the newspapers, he says: "The method of astral communication, if ever one be discovered, will probably not resemble any of those that we can think

of now." After all M. Flammarion leaves us, at the end of several thousand words, practically where we were before, as far as communication with Mars is concerned. But he sets us thinking as to possible future great discoveries among the many secrets that electricity yet has in store for us. The explorer in the realms of solar and terrestrial electrical phenomena has a wonderful field before him and probably stands the best chance of any of solving the mysteries of astral magnetism and interastral communication.

* * *

The Alternating Current and the Eyesight. In a recent note we paid some attention to some recent correspondence in the London *Electrical Review* on the effect of the incandescent light on the eyesight. It was pretty clearly pointed out that an incandescent lamp properly shaded could have no injurious effect on a healthy eyesight, and that the complaints that are made generally emanate from those who use the lights without exercising sensible precautions. Mr. A. Maxwell Waterhouse writes to the *Review* to point out that no distinction is made between the effect produced by a lamp operated from a direct or an alternating circuit. In his opinion this makes all the difference. He acknowledges that a direct current lamp should not affect the eyes more than any other illuminant of the same intensity, and then goes on to say:

"But a filament brought to incandescence by the action of an alternating current is another matter, and that such a lamp, more especially when the frequency of the alternator is low, does have an injurious effect on the retina of the eye, although the alternations may not be visible save for a certain twitching in the light, is a fact which is borne out by experience and cannot be gainsaid. Such a lamp, if not shaded or frosted sufficiently, will in time play havoc with the eyes of a person constantly working by it. I know of a case, and by no means an isolated one, of a billiard marker who was obliged to give up his work in consequence of this. When the alternations are more frequent the effect is not so marked."

Mr. Waterhouse thinks that lamps with frosted bulbs should be used on alternating circuits of low frequency or else special care should be taken to shade the filament, "as if this is not done, the high tension system may come into disfavor with the public for this very sufficient reason." It is conceivable that with a very low frequency the alternations may be apparent in the filament of an incandescent lamp and cause considerable uneasiness if the filament is directly in the line of sight and unshaded in any way, but we think the remedy in this case, as in the other, is simply a proper shading of the light. If this were always done, instead of being done so seldom as it now is, there would be little cause for complaint whether the lights were operated on direct or alternating systems. It would be interesting to know, however, whether in this country, where alternating systems abound, this trouble has often been experienced by users of lamps supplied by the alternating current.

It is intended to place the telegraph and telephone wires in Victoria, New South Wales, underground. The estimated cost of the work is about $400,000, and it is expected that it will be begun at an early date.

FRAUDS IN THE ELECTRICAL BUSINESS.

(*Continued from page* 315.)

Another of these precious frauds is the electric garter. I have seen advertisements, as no doubt many of you have, where the use of electric garters is guaranteed to give a more shapely form to the limbs of ladies. The absurdity of such an appliance is too apparent for comment, but it is really too bad to disappoint and deceive the ladies in a case like that. What swindle under the name of electricity will not be attempted next? Why don't they get up an electrical hat band guaranteed to supply a lack of brains or furnish new ideas to those that wear them? Yet would not such a thing be just as reasonable as some I have described?

As an answer to some of the reckless statements which appear in advertisements and circulars, some of which I have mentioned, in regard to electric belts and other appliances, I will quote an authority and read some extracts from De la Rive's "Treatise on Electricity," De la Rive was at the time of writing his work a member of the Academy of Sciences, and also of Medicine, of nearly every large city in Europe, so that he is an eminently qualified authority to pass judgment on these appliances. After explaining the construction of the electro-galvanic chains and belts of Goldberger and of Pulvermacher, he says:

"We do not very well understand the effect of this arrangement by virtue of which the current is scarcely to circulate in the chain without traversing, at least in a very sensible manner, some part of the body. For not even a derived current can be obtained on account of the imperfect conductibility of the skin. Moreover, no very positive fact has proved the efficacy of this later mode of application, upon which experience has not yet decided." And again: "We do not deny that there may be a production of currents in these apparatus; even the galvanometer indicates their presence; but they are very feeble currents, and we do not see what advantages can be presented by these arrangements which at the very basis rest on false ideas of the electricity of contact."

My wonder is that the electrical journals have not been more outspoken in showing up these frauds on the public. The public would naturally look to such a source for information of this kind, and these journals are not handicapped as others are by being paid for fat advertisments, for it is the uninformed public on electrical matters that the advertisers desire to reach, so they use the daily press and weekly and monthly publications to make known their wares. In summing up this whole matter of fraudulent electrical appliances it seems singular that they have been allowed to exist so long, especially the hair brush; one reason may be that the "public love to be humbugged." But there is a limit to all things, and I predict, as electrical knowledge is being more and more disseminated by such institutions as this college, that it will not be long before people will understand the truth in regard to them. Although I have touched upon but a few frauds and deceptions as practised in the electrical business, I am aware of there being many more which would prove interesting were it not for the risk of tiring your patience. I have no doubt there are those in this audience who remember the electrical sugar refining frauds of a few years ago. Also the motors of Paine, which for many years continued to deceive people. Much might also be said of the tapping of telegraph wires leading to race courses, and the ingenious electrical devices and methods for supplying stock quotations to bucket shops in Wall Street. Also some of the so-called telegraph schools, where young people are induced to pay their money with the promise of a situation as soon as competent. This class of fraud cannot be too strongly condemned.

In concluding this paper I cannot refrain from expressing a few words as to the position of the capitalist or investor in regard to new electrical inventions. In the few instances cited I have endeavored to illustrate how easily an investor may be deceived. It may be fairly asked by some, "Has the investor then no protection from the designs of a dishonest promoter, or from the mistaken though honest inventor?" I answer, he has. There are plenty of good, honest and capable engineers in this and other cities, who, for a reasonable fee, will investigate and report upon any new scheme if they are only applied to. Some of these engineers are peculiarly fitted to give advice and opinions in certain branches of this business by reason of their long experience in such branches, while others have had experience, more or less, in all of them. Besides these individuals there are now lately established in this city electrical firms composed of men of unquestionable reputation and standing, who make it their business to investigate and report upon any electrical invention; and I claim that there is now no excuse for an investor being deceived where such facilities exist for obtaining correct information upon electrical subjects. Would a man afflicted with disease undertake to cure himself if he knew nothing of the study of medicine; or would a man having an important law suit on his hands undertake the management of his own case if he knew nothing of the practice of law? On the same principle, then, an investor takes a large risk if he depends on his own judgment while placing his money in alleged new electrical enterprises. On the other hand, the judicious investment of capital in electrical enterprises has brought large returns to a great many people, and in very many cases handsome fortunes have been realized. As an evidence of this fact, we have but to point to the marvellous success of the telephone, the electric light, and the electric railway. Besides these great industries, there are no end of less important schemes varying in value according to their commercial usefulness, and almost every day something new in the electrical line is being discovered.

WORLD'S FAIR DEPARTMENT OF ELECTRICITY.

The prospects for a grand display in the department of electricity of the World's Columbian Exposition were never better than at the present time. Letters are continually pouring in to headquarters from all parts of the United States asking for information relative to the amount of space obtainable, or to some part of the rules and regulations that have been sent out by the chief of the Department. There is a surprisingly large number of inquiries from foreign countries regarding all classes of exhibits. These letters, coming as they do from all parts of the world, indicate that a lively interest is being taken in the Exposition abroad, and that the general advertising through the press and through circulars sent out from the different departments is having the desired effect.

Herr Vogel, the representative of the great electrical firm of Siemens and Halske, of Berlin, Germany, has returned to Chicago from a short visit to New York. He is still in conference with the electrical department regarding the exhibit which his firm will make. He expects to spend several weeks in looking over the grounds and ascertaining the prospects of the exposition, so that he will be able to make a full report to his company when he returns home. At present he is awaiting some advice from the firm he represents regarding the answers made by the committee on grounds and buildings relative to their proposed exhibit.

The plans and specifications for the construction of the conduit system and subways in which the electric conductors are to be carried through the grounds to the different buildings have just been issued from the construction department of the World's Fair. The specifications call for the

completion of the work by April 15, 1892. The total length of the subway is about 4500 feet. The larger portion of the conduit will be eight feet and four inches square and will be built of the best seasoned pine. The conduit is to have two linings, the outer one consisting of two-inch tarred plank. Between the linings will be a concrete mixture of cement, plaster and sand.

Up to the present time $682,706 has been expended in the construction of the twelve buildings now being erected on the grounds. The third largest amount paid out was for the Electricity Building, of which Arthur Johnson received for carpentry work $77,737.38, John Griffiths, exterior covering, $1,271.26, and Leopold Bonet for plaster models, $6,349.50, making the total amount expended on this building $85,358.14.

NEW YEAR'S EVE AT THE ELECTRIC CLUB.

The 150 visitors who took in the exceptional programme provided by the Electric Club for the entertainment of its members on New Year's Eve enjoyed one of the greatest treats of the season. The most skillful showman could not have selected a more seductive list of attractions than that headed by the name of the well known journalist, Joe Howard, Jr., who gave a racy and interesting talk which he entitled "A Few Plain Words on Journalism." Few men in this city are better fitted, either by experience or personal qualifications, to tell of the ins and outs of a life that, however exacting it may be, is to many full of fascination. Mr. Howard's talk was listened to by the members of the club with great enjoyment, and interrupted by frequent applause. A superb musical programme followed. Heinrich Gruenfeld, Court Pianist to the Emperor of Austria, played a fantasia on themes from Lohengrin and Tannhauser in a manner worthy of his European reputation, and his brother, Alfred Gruenfeld, charmed the audience with several pieces on the 'cello, rendered in masterly style. Mme. Anna Lankow's exquisite voice and artistic method were displayed to advantage in a song from Mignon, and an aria from Delilah, and Mr. Victor Clodia, of the Metropolitan Opera Company, by his rendering of a song of Tosti's, justified the claim of his friends that he is one of the first tenors now in the city of New York. It is seldom that any club has the opportunity to listen to artists of such distinguished talent, and the Electric Club is to be congratulated on having so generously catered for the enjoyment of its members on the occasion. After the concert the Club punch bowl was filled, and the New Year was ushered in with brimming glasses to the strains of "Auld Lang Syne."

MAGNETIC PROPERTIES OF OXYGEN.

Prof. Dewar made a highly interesting communication last week to the Royal Society. He has resumed the investigation of the properties of liquid oxygen, of which he gave some beautiful illustrations at the Royal Institution at the time of the Faraday centenary in the earlier part of this year. Faraday, more than 40 years ago, proved that oxygen alone among known gases is magnetic, and Prof. Dewar sought to determine what effect a temperature of 180 deg. centigrade below zero would have upon its behavior in the magnetic field. Having previously ascertained that liquid oxygen does not moisten or adhere to rock crystal, and consequently maintains in contact with that substance a perfect spheroidal condition, he poured the liquefied gas into a shallow saucer of rock crystal, and placed it between the poles of a powerful electro-magnet. He expected some such result as the total or partial arrest under magnetic stress of the violent agitation caused by the ebullition of the spheroidal mass. But on the magnet being excited, the whole mass of liquid oxygen was literally lifted through the air and remained adherent to the poles until dissipated as gas by the heat of the metal. The feeble magnetism of oxygen at ordinary temperatures had become a force to which no solution of a magnetic metal offers any parallel. Thus was strikingly and beautifully exemplified the relation between magnetism and heat, of which the entire loss of magnetic qualities suffered by iron at a red heat is a familiar illustration. The experiment, interesting and suggestive in itself, derives an added interest from the fact that the electro-magnet employed is the historic instrument with which Faraday carried out many of his classic investigations.—*Electrical Engineer* (London).

A NEW ELECTRICAL INDUSTRY FOR CHICAGO.

It is currently reported that arrangements are about completed between the Thomson-Houston Electric Company and the Pullman Palace Car Company for the erection of a large manufacturing establishment at Pullman, Ill. Negotiations have been carried on between the two companies for a considerable time in regard to the equipment and arrangement of a large shop where they could manufacture and equip their street cars with electric motor and other electrical appliances under the same roof, thus avoiding the trouble and delays that are necessarily caused by building the motors in one city and the cars in another. It is understood that the officers of the Pullman Company have for some time been anxious to have an electric company establish a factory near their works. It will be remembered that negotiations were carried on between the Westinghouse Electric Company and the Pullman Company with substantially the same purpose shortly before the financial difficulties of the former company occurred. It is understood that Mr. B. E. Sunny, manager of the western office of the Thomson-Houston Company, is one of the prime movers in the reported enterprise.

ELECTRICAL EXHIBITS AT THE WORLD'S COLUMBIAN EXPOSITION.*

BY JOHN P. BARRETT.

Electricity, as an adjunct to industrial procedure, has ceased to be empirical. Its practicability and economy, and the conveniences of its employment, are settled and incontrovertible facts. Its conduct under fixed conditions is no longer problematical. The laws which rule its action are as inviolable as those of the exact sciences, as constant as those of nature—of which they are a part.

In making plans, therefore, for an exposition of electrical development, the practical side of the question must be ever uppermost. The chief aim must be to demonstrate beyond cavil that as a factor in the affairs of this workaday age, electricity cannot but be taken into great account. The chief feature, however, would fail of its force were we to neglect to demonstrate at the same time the immense strides that have been made since electricity emerged from a state of mystery and became one of the essentials of civilization and progress. Following out this preliminary reasoning, I think it necessary to treat practical electricity in classes according to the importance and relationship of its application.

The question of railway and other methods for transporting passengers and freight is the most vital economical issue of the present day. Steam, either by locomotive or cable, has been the only feasible motive power up to within a short time. The manifold objections to it, however, have increased the activity of inventors and the possibilities of rich reward have been a stimulus to the energy of electrical workers. Electricity is already a success in some branches of this service, and is fast displacing other motive power. The next few years—possibly the next few months—will probably see the whole question finally settled by some new element or the further development of one or other of the existing electrical systems. It will be part of our duty therefore to give every facility to exhibitors to make displays of new systems, and to exploit the old along new lines and under new circumstances. In order to do this it is contemplated to set aside a parcel of ground at some point of the exposition, on which to build trial tracks, which may be equipped for the different systems. We should make it possible for every system to be shown, so that not only the electrical people may judge of their respective merits, but that visiting capitalists and possible customers may have ready facilities for becoming interested in the subject itself or in any of the various inventions or systems on exposition. It is to be hoped that in this class of work the electrical people will submit something which should decide the question of transportation wholly in favor of electricity—whether it be by means of overhead, conduit or accumulator systems. I have only to say that the public at large and those who are interested in the question from a financial standpoint have high anticipations in this direction, and there is a disposition to wait for developments.

Electric lighting, arc and incandescent, has long ago arrived at a point of practical success. For illuminating purposes electricity is accepted and stands without competition. The developments in this direction will be as thoroughly demonstrated at the Columbian Exposition as it is possible to conceive of. All the various systems of lighting, and of the transmission of power will be placed in practical operation for service. Nearly, if not quite, 25,000 horse-power will be applied to electrical transmission at various parts of the grounds and buildings. It is contemplated to engage each company undertaking work, to wire and equip the locale of its distribution, furnish its own lamps, material and supplies, so that each company's system of construction and operation will stand entirely alone, to show its especial merit or to receive condemnation for failure. In this work, it is contemplated to bring into friendly but brisk business competition the companies and systems of this country and Europe. The questions of the saving of energy by the perfection of machinery and insulation will be closely calculated, and the various systems will be thoroughly tested by the efficient juries on awards, of which more hereafter.

Artistic lighting of theatres, hotels, residences and streets will be given an impetus, placed as these features will be in competition with art in every other conceivable dress. The brisk, practical business methods of the electrical people of this country have left little time to art and æstheticism up to the present time, while the people of Europe have on the contrary led art and electricity hand in hand. The Columbian Exposition may have some surprises in store for visitors in this respect, and will undoubtedly be a source of much pleasure and instruction.

The transmission of power from sources at points along available water-courses, or in the immediate vicinity of fuel for steam, and remote from the desired point of application, has been given much attention of late and much newspaper comment has been made upon alleged successful inventions. This has seemed to me surprising, coming from electrical journals at least, since all of us in this country ought to be aware of the fact that long distance transmission has long been an accepted application of electricity in the mines of the west and south-west, and has done much toward revolutionizing the process of mining. At many points in the west far removed from fuel for steam, and at long distances from water power, mines are being successfully operated that could not have been so if fuel had to be delivered at the mine instead of at the developed power ready for

* A Paper read before the Chicago Electric Club, January 4, 1892.

application. Some new things have lately come into practice in this field of electrical work in Europe, and at the Columbian Exposition we shall see an increased interest in this work of transmission, and there is in contemplation a project to make a most instructive object lesson by placing in practical operation a water wheel motor with wiring and terminals for application at an artificial mine some distance away. The many applications of the electrical current, of various quantities and qualities, in mining and milling work will come under this head, and I am assured of some new and valuable contributions in the way of machinery.

In the whole field of electrical invention moreover, there are promised models of invention setting out new principles, and numberless contrivances will be a part of the exhibit to testify to the large measure of usefulness of electricity in the various directions of its application. It is hoped also that the exhibits accepted will be object lessons to the general public which will inculcate a clear appreciation of the fact that there are legitimate uses of electricity, and that on the other hand there are applications of the current which closely border upon the fraudulent, and which are mere catch-pennies, brought forward wholly because of the mystery and hocus pocus that surround them. I feel it a part of the duty of the Department of Electricity to unreservedly oppose the presence of these things and by discountenancing them, to rob them in a degree of their harmful influence. People must come to understand that electricity is not a mysterious force, uncertain in its operation and liable to all sorts of eccentric deviation from the desired course. Until this understanding has been arrived at by the public, the electrical people will suffer more or less from frauds practised by the unscrupulous, and will meet with obstructions in the shape of legal injunctions to prevent the laying of electric roads and lines of wire for transmission, and the actual dangers of electricity will be magnified many fold by those interested in restricting its use.

The remaining feature of the electrical exhibit, but not by any means the least for being mentioned last, is that part which will create object lessons on electrical progress—the historical exhibit. It would be impossible to fully appreciate the greatness of the progress made, and the magnitude of the work of making commercial electricity what it is to-day, without the presence at any exposition, of the first crude machinery—the initial appliances by which the electrical current was made a useful force. It is contemplated to have some of the original models, and where this is found impossible, to have reproductions of the models of the apparatus of Morse, Franklin, Vail, Henry and many others of our own country, and those of Ohm, Ampere, Gauss, Siemens and many others of Europe. The Department is in correspondence at the present time with those people or governments that have control of museums or institutions of learning where any of this historical apparatus may be, and we earnestly hope to have a full exhibit of these priceless treasures.

It is not contemplated by the National authorities of the Columbian Exposition to offer awards which would have so great an intrinsic value as to attract exhibitors, but it is contemplated to make the standard of excellence so high that the bare acceptance of an exhibit by a department will be a lasting and distinguished honor. In the Electrical Department, the space available for exposition purposes will be so small as compared with the demand, that the greatest judgment will have to be brought into play to decide which exhibits are worthy of a place and which will have to give way. It will be impossible to accept all. Therefore, the presence of an exhibit in the Electrical Building will be a testimonial of its unusual merit. The awarding committees have determined to have full and exhaustive tests made of all machinery in competitive exhibition by the juries of the different departments, and to publish these tests and the jury findings, at the close of the exposition, under the authority of the National Commission.

I regret that it is impossible at this time to present figures and definite information as to the prospects and scope of the department. It is yet sixteen months before the opening of the exposition, and while the amount of space in the department building that has already been applied for is in excess of the total amount available, yet we have heard from fewer than one-half of the probable applicants for space. A delicate task is before the Department, therefore, and it will not be advisable to discuss the question in detail for some months to come, when I hope to have heard from all the electrical people. I shall then be in position to discuss the matter more fully and more in detail in a paper which I shall ask to present.

A MEMENTO OF MORSE'S EARLY EXPERIMENTS.

The American Chemical Society has been holding its fourth general meeting in New York. Their sessions were held in one of the large rooms of the University of the City of New York, in Washington Square, and Professor George F. Barker, of the University of Pennsylvania, in congratulating the assembled convention of chemists on the auspicious circumstances under which they met, called attention to a very interesting fact. The professor stood behind an old desk, which has been there for more than half a century, and which had served the twofold purpose of a pulpit for the chapel exercises, and for such other religious services as were held at the institution, and a table on which experiments in chemistry were performed. Professor Barker stated that it was on this very desk that Professor Morse carried out many of his most important experiments, and pointing to the picture of the distinguished chemist and electrician which had been hung in the room in honor of the occasion, he said that for chemists, the room must be considered holy ground. President Barker further said that he had it from Morse's own lips, that Professor Gale, of the University of the City of New York, had been the support on which he leaned in conducting his experiments with the magnetic telegraph. After some preliminary trials, which had been unsuccessful, Morse lost heart and was inclined to pronounce the whole thing a failure, when Professor Gale suggested the use of coils of wire about the magnet to secure the induced current, and when this was tried the telegraph became a success.

AN ELECTRIC FIRE ENGINE.

Messrs. J. C. Merryweather & Sons, the London firm of fire engine builders, have recently completed an electric fire engine. It is similar, says the London *Electrical Review*, to the steam engines in use in the metropolis and various provincial towns. It is arranged on four wheels with forecarriage and capacious hose and implements and seats for firemen and driver. Instead, however, of the usual boiler, a Siemens motor is substituted for the operation of the pump. The engine is capable of pumping from 350 to 500 gallons per minute, and of throwing one jet to a height of 175 feet, two jets 145 feet, or three jets 100 feet. The pump is so constructed that it will draw its supply of water from tanks, streams, shallow wells, or direct from the street hydrants. The latter is regarded as a very important feature. The hose box contains from 1000 to 1200 feet of "double substance" canvas hose. As far as weight is concerned, that of the electric is rather more than that of the steam fire engine; but notwithstanding this, the former is easily drawn by a pair of horses proceeding at a gallop. The current is derived through a manhole from an underground system, the connection between the motor and the latter being effected by means of a flexible piece of cable.

THE GYMNOTUS ON SHORE.

A STORY OF MISPLACED CONFIDENCE.

A few years ago, the stand of Mr. Blackford, the widely known fish dealer, in Fulton Market, had a special attraction in the shape of an electrical eel, and many were the stories told of its uncanny powers. These were so highly colored that although crowds of people went to see the fish, none could be found who was ready to put its reputed shocking powers to the test. It happened, however, that an electrician, incited by curiosity, found his way to the tank in which the fish swam about unmolested. The eel looked so harmless, and so quiet in his movements that the electrical man began to think that as a means of producing an electric shock he was a base deceiver. The more he pondered over it the more he became convinced that the innocent-looking inmate of the tank had no more electric power than a yard of underwriter's wire, and he secretly resolved to put his suspicions to the test at the first opportunity.

The opportunity soon presented itself. One evening he was one of a party who were returning from the theatre to Brooklyn, where they resided. Making a detour to the Fulton Market, they regaled themselves with the oysters for which that old landmark is famous. After the refreshments were disposed of, the electrician offered to take his friends in to see the wonderful eel. It so happened that one of those present was also in the electrical business, so the proposition was seconded and carried unanimously. After the inspection a question arose as to the voltage of the fish, and our hero, who had long been anxious to test it, got permission from the man in charge to do so. Divesting himself of his coat, which he handed to the wife of his bosom, he rolled up his shirt sleeves above the elbow, and proceeded to action. Down went the hand and arm into the water, and the fingers were brought into contact with the belly of the fish. The eel remained perfectly passive, and seemed rather to enjoy the touch of the fingers than otherwise, showing not the slightest disposition to exhibit its reputed powers. The fishman was told that his eel was no good, and the electrician joined in the chorus of reproach, and said that that was just what he had thought all along. The fishman resented the incredulity of the visitors, and said: "Well, just grasp him around the body." More convinced than ever that the whole thing was a solemn farce the electrician invaded the lair of the mystery of the sea once more, and squeezed its slippery body with a considerable spice of vindictiveness. In an instant, to the accompaniment of an ejaculation which sounded suspiciously like "Holy Moses!" the arm came up out of the depth with the force of the piston of a steam engine, the tremendous jerk with which it was withdrawn bringing up a deluge of water, which drenched everybody around. The disillusioned experimentalist was the picture of astonishment and mortification, as the wild laughter of his friends resounded through the market, and the surrounding fisherman "caught on" to the joke, and joined in the hilarity. He afterwards remarked that he took back all his slighting remarks, as the fish more than justified its reputation, and if he ever got such shock from a 1000-volt dynamo as he did from that eel he would go out of the electrical business.

A REMINISCENCE OF THE DRAFT RIOTS OF 1863.

The recent presentation by John Stephenson, the veteran car-builder, of nine muskets to the Flandreau Post, G. A. R., of New Rochelle, recalls a characteristic incident in the career of the donor. At the time of the riots the firm of John Stephenson & Co. was engaged on Government contract work, car building having been suspended for the purpose of aiding in the equipping of the Union

armies. Against these and like manufacturing establishments the ire of the rioters was particularly directed. It was the boast of the rioters that they would cause the factories to suspend operations and compel the employés, from superintendent to apprentices, to join their ranks. The mob had visited every manufactory, and caused the works to be stopped, and obliged the workmen to fall into line, and they advanced on the Stephenson factory with the same end in view. They had, however, in its doughty head, a man of sturdy mould to deal with. As a youth he had served his time in the Twenty-seventh Regiment, New York State Militia, now the Seventh Regiment of the existing State force of volunteer soldiery, and he determined at all hazards to protect his factory against all comers. He speedily organized a military company out of the Americans and Germans of which his employés principally consisted, and sent around to the State arsenal at Thirty-fifth Street and Seventh Avenue for twenty-five stands of small arms, and a couple of field pieces. The arms were sent to the factory in a grocer's wagon, and safely smuggled into the building unmolested by the rioters. The entrances to the shop on Twenty-seventh and Twenty-eighth Streets were barricaded inside with heavy four-inch ash plank. The windows were covered from the floor to about eight feet high, leaving space between the planks for the muskets. A howitzer, loaded with scrap iron commanded the Twenty-eighth Street entrance while the Twenty-seventh Street doorway contained two twelve-pound steel rifled cannon. Fortunately, the imposing show of the extemporized battery had such a moral effect that there was no necessity for putting its efficiency to a practical test. In all probability, had the triggers of the ramshackle old carbines ever been pulled the results would have been more serious to the men who handled the weapons than to those against whom their fire was directed. The factory was used after that by the United States Government for the space of two years, and when peace was proclaimed Mr. Stephenson took up his regular business again. As the arsenal had more muskets in those days than it knew what to do with, Mr. Stephenson's draft was never sent back, and for twenty-seven years they have been stored away, an almost forgotten reminiscence of the stormy days of 1863.

FRAUDULENT ELECTRIC LIGHTING.

The inhabitants of Plainfield, N. J., have for a long time been dissatisfied with their electric lighting service, and a committee has been appointed by the City Common Council to investigate the charges of fraud which have been brought against the company supplying the light. This committee has just given in its report. Detailed reports were submitted of tests made by experts from Stevens' Institute of Technology, and the Edison Laboratory, which declared that the city has been receiving only two-thirds of the value of electric lighting it has been paying for. Payment of the December bill for lighting was refused, as partial reimbursement to the city of its alleged losses. Further action will be taken by the city.

THE W. S. HILL ELECTRIC COMPANY.

The W. S. Hill Electric Company held an impromptu reception on Monday last, for the purpose of extending a New Year's welcome to their many friends. Their offices in the Electrical Exchange Building were throughout the day thronged with visitors, who gladly availed themselves of the opportunity of conveying to the new organization their best wishes for its success, and of enjoying its bounteous hospitality. Mr. W. S. Hill has for the last fifteen years carried on the prosperous business in Boston, and is president of the present firm, of which Mr. George H. Poor is general manager, and whose office is in charge of Mr. Ernest A. Des Marets.

Although the New York office was opened only last November, the orders received by the house for all descriptions of electrical supplies are already largely in advance of the output, and an extension of the factory at 133 Oliver Street, Boston, will shortly have to be made. An idea of the area over which the demand for the supplies of the firm extends may be gathered from the fact that one of their recent orders was for a couple of converter switches for the local electric lighting company at Helsingfors, the most northerly town in Europe using the electric light, which for three months in the year is in requisition twenty-four hours daily.

Dr. Simeon Snell, who has given much attention to the use of the electromagnet in extracting foreign bodies from the retina, had a letter in the *Lancet* recently, giving some particulars of his operations. Dr. Snell has put on record 77 cases in which the electromagnet has been used, and subsequent cases bring the number to 100.

THE TRANSMISSION OF ENERGY.

Last Wednesday evening, Professor Dolbear, of Tufts College, delivered the fourth lecture of the series now being given before the members of the Thomson Scientific Club, in Odd Fellows Hall, Lynn. His subject was, "Ether, or How Energy is Transmitted Through Space."

In substance the lecturer said:—In the field of physics is considered energy, all forms of which are convertible. Energy is exerted by means of motion. There are three kinds or classes of motion. Translatory motion is the movement of a mass through space. Vibratory motion is the change of a position of a portion of a mass through space, as the arms of a tuning fork will vibrate while the body of the fork remains quiet. Rotary motion is the turning around of a mass without changing its position in space. These three kinds of motion are all shown, in more or less complex action, in a sewing machine. Wherever there is motion there is energy, and the mass of matter and the motion constitute the two factors of energy.

The mere dimensions of the mass of matter are not important. The motion of molecules is a source of energy, and to give some idea of the size of a molecule some elaborate figures were added. The most powerful microscopes rendered visible a point about 1—100,000 part of an inch in diameter. There is reason for believing that a single molecule is much smaller even than that. One reason for this belief has been deduced from the soap bubble. Scientists have measured the thickness of the envelope of soapy water enclosing the air of the bubble when it had become so thin as to produce rainbow tints. At the appearance of the shade of violet it was one-fourth the thickness of the length of an ordinary violet wave of light—one-sixty-thousandth of an inch, thus making the thickness equal to one-two-hundred-and-forty-thousandth of an inch. As the bubble continued to expand a black patch formed adjacent to the pipe from which the bubble was being blown, and the thickness of such patch has been found to be only one-fortieth of the thickness of the violet section, or about one-fifty-millionth of an inch. Accepting that as a unit, although Professor Dolbear said there was every reason for believing that the diameter of a molecule is much less than the thickness of the black patch of the soap bubble, it was shown that there must be at least 123,000 trillion molecules in a cubic inch of air, if they were all touching each other. From these formidable figures about 1,000,000 might be subtracted to allow for the air space which surrounds the molecules.

The impossibility of obtaining a perfect vacuum was shown conclusively by the fact that, although the density of the air at a height of 200 miles above the surface of the earth is 10,000,000 times rarer than can be produced in the most perfect vacuum yet achieved, there were still remaining in such a vacuum 125 billion molecules. Allusion was then made to the particular kind of motion of these small molecules. The molecular motion which causes heat is a change in form. It was formerly believed that heat was a sort of substance, and it was named caloric. Count Rumford and Sir Humphry Davy demonstrated that the caloric theory could not be sustained. It took 30 or 40 years for that opinion to result in the general conviction that heat is a mode of motion.

Conduction is the technical name of the process by which the heat of a hot body may be transmitted. A body that was not retarded would move on forever in what is called "free-path" motion. It would not give up any of its energy, having at the end of any assignable time just as much as it started with. In other kinds of motion there is loss of energy.

Two hundred years ago Sir Isaac Newton said it was absolutely impossible for anybody to impart motion to any other body not in contact with it. Such a theory was too foolish to believe. Newton evidently did not consider the possibility of an intervening medium. Logically there must be some sort of a medium between the two bodies, such as the sun and the earth. Light travels at the rate of 186,000 miles per second, and as there are 50,600 wave lengths to an inch, the enormous number of 500,000,000,000,000 vibrations takes place in each second of its passage. The medium of its travel must be something as capable of multitudinous motion as a molecular quantity. That medium is the "ether," and it is a molecular quantity like all other matter.

The magnitude of the volume of ether can be understood from the fact that light travelling 186,000 miles a second requires 10,000 years to traverse the distance between the farthest visible stars on one side of us and the farthest visible stars on the other side. "There is doubtless an endless succession of solar systems extending beyond these limits," said Prof. Dolbear, "but a world which it takes 10,000 years for light to cross is quite large enough for any purpose." We are to suppose that space is filled completely and solidly with ether. None of it can escape, and it has other properties than the transmission of light. It constitutes the element of maintaining the magnetic field. The velocity of magnetic disturbance is the same as that of light, electro-magnetic movements having been found to travel 186,000 miles a second. Every molecule of any kind of matter is a magnet. If that be so, would not the changing forms set up electro-magnetic waves?

This latter proposition the lecturer established as a fact by a number of very interesting experiments, which were watched with the closest interest by all present who warmly applauded Prof. Dolbear at the close of his very instructive address.

FROM NEWS CENTRES.

BOSTON.

BOSTON, JAN. 2.—Messrs. Pinkham and Godfrey, constructing electrical engines, have just installed a 3 H. P. Eddy motor in their new factory, and it is now operating their lathes, drilling machines, circular saw and other tools.

In view of the strained relations between the United States and Chili, orders have been received at the Thomson-Houston Electric Factory from the government to make all possible haste with the electrical equipments for the gunboats and cruisers which the company now has in hand.

At last an agreement has been arrived at between the West End Railway Co. and its employés, which is highly satisfactory to all. It went into operation yesterday, Jan. 1st, and will run for a year at least. Everyone is delighted at the cessation of hostilities. The agreement is alike creditable to the sound, practical sense of the men and to the

fair dealing and even handed justice of the directors of the company. The men on the electric cars are specially provided for.

The extension of the electric railway system in Brockton is being rapidly pushed by the Improvement Association, which recently acquired full control of the street railway systems in that city. In a short time every car will be propelled by electricity. The total number of miles of railway to be electrically equipped will be about 15, connecting Brockton with Whitman, Randolph and Avon. The consolidated roads will then be under the entire management of Mr. H. B. Rogers, who for many years was superintendent of the Brockton Street Railway, operated by horses. The syndicate controlling these consolidated roads intends next spring to extend the system to Holbrook, Easton and Stoughton.

The big new carpet warehouse just built for John H. Pray, Sons & Co., in Washington Street, has been equipped with 5000 lights, which will receive current from the Edison central station on Head Place.

The new arc light plant recently installed by the Edison General Electric Co. at Watersville, Me., has recently started up and is welcomed by every one. There are 60 arc lights in the streets which the citizens appreciate immensely.

The new double decked Pullman cars recently ordered by the West End Railway Co. are being delivered and will run on the Cambridge section of the road. These cars are now the most popular vehicles used by the company.

The Boston Electric Club, which from its inception in 1887, has passed through a somewhat chequered existence, is to be perpetuated by an "inaugural dinner for 1892," to be held at the Parker House, January 11, at which quite a number of past and present members are expected to be present. Professors Elihu Thomson and Charles R. Cross have accepted invitations.

A very attractive new circular has recently been issued by the National Telephone Manufacturing Co. of this city, whose short distance telephone is extensively used. It is giving the most unqualified satisfaction. Mr. H. M. Flagler's colossal hotels in St. Augustine, Fla., are being equipped and connected with these instruments.

A railway supply department has been opened by the Thomson-Houston Electric Co. at its Boston headquarters which is found very useful by the many branch offices and departments throughout the country. Every conceivable device is carried, so that any order can be promptly filled, whether from roads using the Thomson-Houston or any other system.

The new illustrated catalogue issued by the W. S. Hill Electric Co. has resulted in a number of inquiries for the specialties manufactured by this company. This handy pamphlet should be in the hands of central station superintendents and isolated plant managers, for it gives cuts and data pertaining to devices which are always in demand.

A syndicate of wealthy capitalists has been incorporated as the Post Engineering Co. and will take over the old established business known as John Post, Jr., and Co. A specialty will be made of contracting for the complete erection and equipment of steam and electric light and power plants. The company will also be New England agents for the Standard Ide and Ideal engines. Mr. John Post, Jr., the well known engineer, is president and A. R. Brown, treasurer.

W. S. K.

MONTREAL.

MONTREAL, JAN. 2.—It is interesting to note many of the ideas which spring up now and then in regard to the capacity of the primary battery as a means of obtaining power. It is understood that one of the electrical supply houses of this city received a letter from a baker wishing to know how much space to leave in some new premises, for Leclanché cells to operate a 5 H. P. motor. The answer that followed was to the effect that he had better leave all the premises and camp himself out in the back yard. The same firm has been requested to light a church by primary cells. It is needless to say that the firm declined in favor of the electric light company. If people could have clearly explained to them the difference in cost between the consumption of zinc with acids in a battery and the burning of coal under a boiler they would cease to associate zinc with horse-power.

An enterprising dentist of this city, Dr. Brown, has been carrying on some very elaborate electrical experiments in connection with dentistry. He has taken out patents both in the United States and Canada for his dental drills and motor attachments, and has no doubt done a great deal towards the hoped for system of "painless dentistry." His office is fitted up in much the same way as that so ably described by Mr. Kells in his article on "Dental Electrics" in the issue of ELECTRICITY for Dec. 23d. Instead, however, of being able to obtain the 110-volt current to operate his dental drills and lathes, Dr. Brown uses four type ΠS., 120 ampere-hour Julien accumulators. The cells are arranged so that by means of a switch the operator can turn on one alone, or two, three or four in series, as his work requires. He is about to employ the alternating current for lighting his office, the direct current not being available in his vicinity. He is in a position to supply his dental drills to any party wishing to procure them, and has fitted out Dr. Brosseau with two 1/8 H. P. motors together with the necessary dental appliances and storage cells.

The Queen's Opera House, which has recently been remodelled from the old Queen's Hall, bids fair to be the best theatre in Montreal. In a previous letter allusion was made to the use of electricity as applied to theatre foot-lights. Electricity is employed to light the entire hall, and when the full number of lamps are turned on, it is one blaze of light bringing out every feature and pattern. The handsome electroliers adorning the corridors and boxes were supplied by the Edison General Electric Co., while the lights are run from the 52-volt alternating current supplied by the Royal Electric Co. The switchboard is compact and well fitted with double-pole switches of the jack-knife pattern. The electrician in charge is Mr. Cooney, who is proving in every way competent to handle the lighting effects in a way very gratifying to the theatre managers.

The Edison General Electric Co. has lately added to the St. Henri plant two 50-light arc machines, to be used for lighting Cote St. Paul, and a 400-light incandescent machine to further increase the lighting of Cote St. Antoine and St. Henri. The same firm has obtained the contract to wire the new science buildings of McGill University. The Edison Co. also supplied some handsome electroliers for the new Y. M. C. A. building.

The Royal Electric Co. has recently sold a 500-light alternating current dynamo to a contractor in St. John Baptist village.

The Church of St. John the Evangilist has lately installed an electric organ-blowing plant operated by four 450 ampere-hour Roberts' accumulators.

An agent of the Bradbury Stone Storage Battery Co. has recently been in Montreal endeavoring to sell Canadian patent rights.

Mr. Andrew T. Keegan, of the firm of Keegan-Miln & Co., dealers in electric light supplies, has retired from business.

H. T. B.

NEW YORK.

DEC. 2.—The first message of David A. Boody, the new mayor of Brooklyn has created somewhat of a surprise. Mayor Boody has vetoed the trolley resolution. The elevated railway men are as jubilant as the street car combine is dejected, and there will be a close fight between them for the victory within the next two or three days. It is understood that Mr. Boody's objections are based partly on the ground that the introduction of the electric trolley would add a new element of danger to traffic, and partly on the unsightliness of the poles and wires. A year or so ago he expressed himself in decided opposition to the trolley, and his opinion has apparently not been changed by the arguments presented by the railway officials at the various hearings before the Railway Committee of the Board of Aldermen. At the same time, Mr. Boody is understood to state that if the railway companies can convince him that the trolley is not fatal to human life, he may yet give in his approval of the proposed measure. Considering that the trolley is in operation in many of the principal cities in this country, and that in the number of years since its introduction not a single person has been killed by the current concerning which such nonsense is talked, the necessary proof is not hard to find. The new mayor holds strongly to the opinion that for so valuable a franchise the companies should be compelled to pay something to the city. It is not improbable that the resolutions for the granting of the franchises may be adopted over the mayor's veto in the early part of next week.

A decision has been given by Judge O'Brien of the Supreme Court in favor of Mayor Grant, who was sued as Sheriff by the United Lines Telegraph Company, to restrain him from levying on its property or selling the same in order to collect the amount of a warrant for $726.71, issued by the State Comptroller in 1887. Under an act of the Legislature, the Comptroller assessed the telegraph and electric light companies to cover the expenses of the Subway Commissioners. The first warrant issued against the United Lines Company was for $1,475 and the next for $726.71 was issued in December, 1887. It was placed in the hands of Sheriff Grant for collection. The action was brought to stay its collection as being unauthorized and illegal.

In the report of the Commissioner of Public Works on the work done by the various bureaus of his department during the year 1891, Mr. Gilroy states that during the year 1,118 new gas lamps and 103 electric lamps were placed and lighted on 15½ miles of new streets. There are now 27,080 gas lamps and 1,196 electric lamps in use, lighting 525 miles of streets, 2½ miles of piers and bridges and 89 acres of public parks and places. There are 1,307 miles of gas mains in the streets of the city.

Mr. E. C. Bradley, manager of the telegraph system of the Pennsylvania Railroad, has been appointed General Manager of the Postal Telegraph Cable Company, taking part of the duties now performed by President Chandler.

A block system is being introduced upon the part of the Long Island Railroad between Long Island City and Jamaica. It is found that the old plan of regulating the intervals between the trains by three minute sand glasses supplied to the flagman, is totally inadequate to the present requirements of the road. Under the block system, applied to short sections, trains can be run much closer together. Eleven signal towers have been built on the line in the nine miles between Long Island City and Jamaica, seven of which were designed especially for block signals, while four have been used as interlocking towers. The system is so simple that any flagman or gateman can operate it. The new arrangement will be a telegraph system with a bell signal code, and it will absolutely prevent any two trains from ever being on the same block at the same moment. The company proposes to extend the block system over all its double track roads, and it is expected that the entire work will be completed by June 1st.

Another provision for ensuring greater immunity from accidents is being adopted on many of the grade crossings of the Erie Railroad. Automatic bell signals are being used for these crossings in places where the public roads are so little used that there are no flagmen or gates. A train approaching in either direction starts an electric gong at the crossing, which can be heard an eighth of a mile away.

In the finding of the jury impanelled to inquire into the recent accident on the New York Central Railroad, near Hastings, a verdict of manslaughter in the second degree was found against Brakeman Herrick; and Augustus Ossman, the train despatcher, is pronounced an accessory to the death of the twelve whose lives were sacrificed. The verdict furthermore censured the railroad company "for employing utterly incompetent men to discharge the duties of responsible positions," and the station agent Delanoy "for not finding out the cause of Brakeman Herrick's appearance at his station with his danger signal." The jury finally recommended that the company adopt a system to make the lives of passengers more secure. That the last clause should have been necessary is an outrage, and the real responsibility for the deaths of the victims of the accident will be placed by the public on the heads of the men who for the sake of economy neglected to provide their line with a block system that would have made such a disaster an impossibility.

AN ADDITION TO THE CHICAGO FACTORY OF THE WESTERN ELECTRIC COMPANY.

The Western Electric Company has at last secured a very desirable piece of property adjoining their manufacturing establishment. On account of their rapidly increasing business the company found it necessary two years ago to add two stories to their factory. They were hardly settled in the upper stories before they found themselves as crowded as ever. They then began to look for room to make an addition; the result was the purchase, from the firm of Collins and Burgie, stove manufacturers, of the large three-story building and lot directly north of the Western Electric factory. The land has a frontage of 318 feet on Congress Street and 193 feet on Clinton. It is expected that the Western Electric Company will erect a large new building in place of the present structure and extend their works across the alley which now separates the two buildings. The purchase price is stated at $320,000.

WESTON ELECTRICAL MEASURING INSTRUMENTS AND APPLIANCES AT THE FRANKFORT ELECTRICAL EXHIBITION.

The Weston Electrical Instrument Company, Newark, N. J., decided at the last moment to exhibit their ammeters and voltmeters and other electrical measuring instruments at the Frankfort Electrical Exhibition. In taking this course the company

was well aware that the instruments would be subjected to close scrutiny by many of the most competent and eminent electricians and electrical engineers of Europe, and would be brought into direct competition with those made by European and other makers of high grade instruments. They felt great confidence, however, in the merits of its goods, and were certain that if the instruments were thoroughly examined and tested, their great accuracy, permanency, portability and convenience would commend them to the favorable notice of the European electricians and engineers. Recent developments show that the confidence of the manufacturers in the merits of the Weston instruments was not too great. The company had received favorable notice in many of the German scientific journals, and, what is more important, numerous orders for voltmeters and ammeters from many of the best electrical engineering firms in Germany and other countries; including Siemens & Halske, Ganz & Co., Shuckert & Co., Lahmeyer & Co., Allegemeine Electricitats Gesellschaft, the Societa Generale Italiana di Elettricita and the Brush Electrical Engineering Company. Orders have also been received from many of the most distinguished electricians of Europe, among whom are Prof. H. F. Weber of Zurich, Prof. Kittler, Prof. Kohlrausch, Prof. Perret and Prof. Lichtheim. Prof. Weber was a member of the Testing Commission of the Frankfort Exhibition, and had an opportunity of thoroughly examining into the merits of the Weston instruments.

The Exhibit at Frankfort was made by the Weston Company under peculiar difficulties. It was not decided to make an exhibit until the last moment, when no space was available, and room had to be secured in an annex. The instruments were not made especially for the exhibition, and if anything were inferior in finish to those sent out in the regular course of business. A large and comprehensive exhibit of measuring instruments was prepared in a very short space of time and there was no opportunity for taking extraordinary pains to render them invulnerable to criticism. Having now opened the way for European trade the Weston Company expect that the orders they have already filled as a result of their exhibit at Frankfort will result in bringing them many more.

PERSONAL NOTES.

Mr. E. J. Garfield, secretary of the Thomson-Houston Electric Co., is hard at work once more, after a long trip to the west, during which he did some very profitable business for his company. Mr. Garfield has just recovered from a severe attack of the grip.

Mr. Louis Magee and Mr. Ernst Thurnhauer, German and French representatives, respectively, of the Thomson-Houston International Electric Co., sailed for Europe last Saturday.

COMMERCIAL PARAGRAPHS.

The Electric Appliance Co. found the last week of the old year an exceptionally busy one, as Mr. Willard W. Low, the president of the Company, returned home from a business trip with a large number of orders.

The "C. and C." Electric Motor Co., New York, installed a lighting plant about a year ago at the St. Nicholas Hotel, Cincinnati. The plant originally consisted of two "C. & C" 300-light dynamos. These have worked so well that the number of lamps has been increased and another 40-kilowatt machine of the same type has been ordered.

The Easton Electric Company, of Brooklyn, lately sold to the Messrs. J. S. & G. F. Simpson, of 28 Rodney Street, Brooklyn, a six hundred light incandescent plant, operated by a No. 9 Easton dynamo. The plant includes a number of the Easton arc lamps, which are operated on the incandescent circuit. The entire installation was made by the Easton Company. The plant is in daily operation and gives entire satisfaction. This is the sixth large plant which the Easton Company have lately installed in Brooklyn. This fact is good evidence that the work of the Company is appreciated at home.

Some quick work has been done in connection with the rearrangement of the Chicago Arc Light & Power Company's Station, recently destroyed by fire. On December 8th, this Company placed an order with the Chicago Office of the Pond Engineering Co., for a 200 H. P. Armington & Sims Engine. The engine was shipped, complete, from St. Louis on the 9th inst. The railroad company delivered it in Chicago on the 14th, and on the 17th inst. the engine was ready for operation, and is now regularly driving six 50-light arc dynamos.

Mr. George Cutter, the well-known dealer in electrical specialties is sending out to his friends a New Year's card embellished with a design of suspended arc lamps that cupids instead of devils are trifling with.

Alfred Moore, Philadelphia, manufacturer of insulated wires and cables, is sending out a very large and handsomely engraved calendar for 1892 to his business friends, whom he wishes to remind of the fact that their orders for insulated electric wires, flexible cord or cables are always acceptable.

INCORPORATIONS.

Municipal Fire and Police Telegraph Co., Kittery, Maine; capital stock, $250,000; to manufacture and deal in police, fire, telegraphs and other electrical apparatus; promoters, John Q. A. Brackett, Arlington, Mass., Moses G. Crane, Newton, Mass., W. M. Chapman, Needham, Mass.

Clemens Electric Mfg. Co., Attleboro, Mass.; capital stock, $25,000; manufacturing electric supplies and equipments; to carry on the business of contracting and constructing engineers; promoters, Geo. Demarest, Plainville, Mass., Maynard E. Clemens, Attleboro, H. G. Bacon, Plainville, M. B. Short, Philip E. Brady, Attleboro, Chas. T. Guild, No. Attleboro, Mass.

The Crawford and Ft. Robinson Motor Line Co., Crawford, Neb.; capital stock, $50,000; to construct a steam or electric motor line between Crawford and Ft. Robinson; promoters, M. A. Manning, C. E. Ellis, Leroy Hall, Crawford, Neb.

The A. C. Robertson Co., Princeton, N. J.; capital stock, $50,000; to manufacture electrical supplies of every description and to sell the same; promoters, A. C. Robertson, Wilkes-Barre, Pa., A. G. Carpenter, E. W. Carpenter, Princeton, N. J.

The United States Portelectric Company (Incorporated in W. Va.), New York City, N. Y.; capital stock, $5,000,000; conducting the business of propelling, conveying, etc., by electrical means, the merchandise and other articles of trade, and manufacturing the apparatus and machinery for the above purposes; promoters, Thos. L. James, John Stratton, Abram J. Dottenhoefer, all of New York City, N. Y.

DuLaney Clock Co., Chicago, Ill.; capital stock, $300,000, manufacture, sell, lease and deal in electrical clocks and other time pieces, clock ornaments and other art goods; electrical appliances and apparatus, time registering devices, motors and meters; promoters, Jas. W. DuLaney, Chas. S. Perry and Chas. F. DuLaney.

Royal Electric Shield Co., Portland, Maine; capital stock, $200,000; manufacture and deal in electrical goods and appliances; promoters, Alfred E. Hill, Somerville, Mass., Nelson E. Hollace, Boston, Mass., J. Wm. Philpot, Lynn, Mass.

The Canisteo Valley Electric Railway Co., Canisteo, N. Y.; capital stock, $20,000; to operate a street surface railway; promoters, Wm. T. Bailey, Geo. L. Davis, Wm. E. Stephens, all of Canisteo, N. Y.

The Breckenridge Electric Co., Denver and Breckenridge; Col.; capital stock $20,000; to generate and distribute electricity for light, power and heat to the inhabitants of the town of Breckenridge, Summit Co., Col; promoters, Horace M. Hale, Hal Sayr, and Irving Hale.

Crown Point Electric Illuminating, Heating and Power Co., Crown Point, Lake Co., Ind.; capital stock, $60,000; is to purchase, own and maintain an electric plant for the purpose of manufacturing and furnishing electricity and electrical power for illuminating, heating and motor purposes; promoters, Edwin L. Jeffrey, Chicago, Ill., George A. Bell, Cobden, Ill., Walter H. Tompkins, Crown, Point, Ind.

Dolgeville Electric Light and Power Co., Dolgeville, N. Y., capital stock, $25,000; manufacture and use of electricity for light, heat and power; promoters, Alfred Dolge, Dolgeville, N. Y., Edmund R. Wanckel, N. Y. City, N. Y. and Otto Voigt, Dolgeville, N. Y.

North River Electric Light and Power Co., New York City, N. Y.; capital stock, $200,000; manufacture and use of electricity for light, heat and power in the City of New York and adjacent towns; promoters, Henry D. Fuller, Bayonne, N. J., Robert Maitland, Brooklyn, N. Y. and Henry C. Adams, Jersey City, N. J.

National Railway Exposition, Chicago, Ill.; capital stock, $10,000; to exhibit railway, electrical and other mechanical appliances and inventions, and to manufacture and sell the same; promoters, Henry Schofield, Richard A. Morrison, Albert Brodie Stone.

Chicago Town Co., Chicago, Va.; capital stock, $500,000; real estate and improvements; water, gas and electric works; promoters, J. P. Carson, R. L. Dejarnette, P. Clark, R. W. Wathins, W. P. Barksdale.

The North Baltimore Electric Light and Power Co., North Baltimore, Ohio; capital stock, $50,000; conducting and operating an electric light plant for illuminating puroposes, and furnishing electric and motive power; promoters, A. G. Henry, W. S. Coon, W. H. McMillen, L. Wooster, D. E. Peters.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DEC. 29, 1891.

DYNAMOS AND MOTORS

465,853. Electric Machine. Thomas H. Hicks, Detroit, Mich. Assignor of two-thirds to George F. Case and E. D. Richmond, same place. Filed May 9, 1890.

465,855. Alternating Current Dynamo. Thomas H. Hicks, Detroit, Mich. Assignor of one-half to H. L. Obetz, same place. Filed Jan. 3, 1891.

465,973. Armature for Dynamos or Motors. Thomas A. Edison, Llewellyn Park, N. J. Filed Mar. 23, 1891.

465,970. Armature Connection for Motors or Generators. Thomas A. Edison, Llewellyn Park, N. J. Filed Mar. 26, 1891.

465,994. Alternating Current Dynamo. Thomas H. Hicks, Detroit, Mich. Assignor of one-half to H. L. Obetz, same place. Filed Mar. 9, 1891.

465,990. Brake for Electric Motors. Alton J. Shaw, Muskegon, Mich. Filed Sept. 21, 1891.

466,028. Governing Device for Electric Motors. William Baxter, Jr., Baltimore. Md. Filed April 14, 1891.

ELECTRIC LAMPS AND ACCESSORIES.

465,983. Cut-Out. Henry W. Fisher, Pittsburgh, Pa. Filed Mar. 2, 1891.

465,997. Electrical Switch. George B. Martratt, Troy. Assignor of one-half to Charles E. Martratt, Albany, N. Y.

466,052. Electric Plug Circuit Closer. James L. Kimball, Boston, Mass. Filed Jan. 22, 1891.

466,244. Electric Switch. William J. Kelly, Boston, Mass. Assignor to John P. Cushing, same place. Filed June 29, 1891.

466,245. Controlling Apparatus for Incandescent Light. William J. Kelly, Boston, Mass. Assignor to John P. Cushing, same place. Filed Aug. 7, 1891.

466,288. Lamp Socket. Jesse L. Hinds, Syracuse, N. Y. Assignor to the Electric Engineering & Supply Co., same place. Filed July 23, 1891.

466,289. Lamp Socket. Jesse L. Hinds, Syracuse, N. Y. Assignor to the Electric Engineering & Supply Co., same place. Filed July 23, 1891.

466,290. Lamp Socket. Jesse L. Hinds, Syracuse, N. Y. Assignor to the Electric Engineering & Supply Co., same place. Filed July 23, 1891.

ELECTRIC RAILWAYS.

465,844. Electric Railway. Julius Emmner, Jr., Washington D. C. Assignor, by direct and mesne assignments, to Philip T. Dodge, trustee, same place. Filed Oct. 30, 1890.

465,866. Electric Railway. Henry S. Pruyn, Hoosick Falls, N. Y. Filed June 25, 1890.

466,101. Electric Railway Switch. Max Kerstein, Boston, Mass. Assignor of two-thirds to Henry Kramer and Robert Fabery, same place. Filed May 16, 1891.

466,180. Electrically Driven Locomotive. Everard H. Morgan, Dover, Eng. Filed Mar. 9, 1891.

466,196. Electric Railway Trolley and Support. Wilbur A. Stevens, Kansas City, Mo. Filed Sept. 22, 1890.

466,212. Electric Car Brake. La Motte C. Atwood, St. Louis, Mo. Assignor to the Atwood Electric Co., East St. Louis, Ill. Filed Jan. 10, 1891.

TELEGRAPH, TELEPHONE AND SIGNALLING APPARATUS.

465,832. System of Synchronism for Telegraphy. Gilbert A. Cassagnes, Paris, France. Filed June 26, 1891.

465,989. Signal Transmitting Apparatus and System. Henry A. Chase, Boston, Mass. Assignor to Albert Watte, same place. Filed Mar. 4, 1891.

465,990. Signal Transmitting Mechanism. Henry A. Chase. Boston, Mass. Assignor to Albert Watte, same place. Filed July 10, 1891.

465,971. Means for Transmitting Signals Electrically. Thomas A. Edison, Menlo Park, N. J. Filed May 23, 1885.

465,972. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed Nov. 18, 1889.

465,991. Electric Signalling Apparatus. Frederick W. Cole, Newton, Mass. Filed Jan. 6, 1880.

466,053. Electric Signalling Apparatus. Bernice J. Noyes, Boston, Mass. Filed Nov. 4, 1890.

466,058. Electric Game Register for Pool Tables. Carl A Erickson, New Britain, Conn. Filed Aug. 24, 1891.

466,063. Electric Annunciator. Frank C. Colville, Oakland, Cal. Filed March 26, 1891.

466,306. Electric Fire Alarm System. Henry F. Jacobs. Milwaukee, Wis. Assignor to Frank G. Bigelow, Moses H. Brand and George Knowles, Jr. Filed Mar. 13, 1889.

CONDUITS, CONDUCTORS AND INSULATORS.

465,961. Insulator. Guiseppe S. Albanese, Orange, N. J. Filed Apr. 3, 1891.

466,250. Electric Conductor. Joseph W. Marsh, Pittsburgh. Pa. Assignor to the Standard Underground Cable Co., same place. Filed Sept. 30, 1891.

466,268. Electric Cable. William A. Conner and Joseph W. Marsh, Pittsburgh, Pa. Assignor to the Standard Underground Cable Co., same place. Filed Feb. 10, 1890.

MISCELLANEOUS.

465,081. Electrical Pyrotechnics. Pierre C. E. Champion. Paris, France. Filed May 15, 1891.

465,854. System of Electrical Distribution. Thomas H. Hicks. Detroit, Mich. Assignor of one-half to George F. Case. same place. Filed Dec. 26, 1890.

465,949. Electric Cane. Alfred W. Roovers and Alexander H. Roovers, Brooklyn, N. Y. Filed March 13, 1891.

465,958. Lightning Arrester. Alexander Wurts, Pittsburg, Pa. Assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Oct. 5, 1890.

466,611. Electric Pendulum Clock. Henry Phillips, New York. N. Y. Filed Mar. 11, 1891.

466,037. Electrically Operated Elevator. Frank T. Herdman, Indianapolis, Ind. Filed Feb. 24, 1891.

466,087. Temperature Regulating Device for Electrical Circuits. Edward Weston, Newark, N. J. Filed June 4, 1891.

466,131. Art of and Apparatus for Heating Metal Articles by Electricity. Edwin E. Angell, Somerville, Mass, Assignor to the Electrical Forging Company, of Maine. Filed March 16, 1891.

466,132. Electric Forge. Edwin E. Angell, Somerville, Mass. Assignor to the Electrical Forging Company of Maine. Filed Mar. 18, 1891.

466,133. Electric Forge. Edwin E. Angell, Somerville, Mass. Assignor to the Electrical Forging Company, of Maine. Filed Mar. 23, 1891.

466,138. Secondary Battery Plate. Henry G. Morris and Pedro G. Salom, Philadelphia, Pa. Filed July 5, 1891.

466,266. Electric Heating Tool. George W. Blanchard. Waterville. Me. Assignor to the Electrical Forging Company, of Maine. Filed April 3, 1891.

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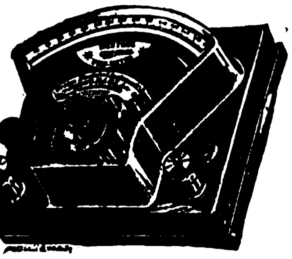

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